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# ENVIRONMENTAL RESEARCH

## RESEARCH AND TECHNOLOGY BRANCH

INVENTORY OF RESEARCH  
AND DEVELOPMENT PROJECTS  
1990



Environment  
Ontario



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RESEARCH AND TECHNOLOGY BRANCH

ENVIRONMENTAL RESEARCH PROGRAM

INVENTORY OF RESEARCH  
AND DEVELOPMENT PROJECTS

1990

1950-1951

RESEARCH AND TECHNOLOGY  
ENVIRONMENTAL RESEARCH



INVENTORY OF RESEARCH AND DEVELOPMENT PROJECTS

1990

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## INTRODUCTION

The Ontario Ministry of the Environment, Research and Technology Branch publishes the Inventory of Research and Development Projects annually in order to ensure the dissemination of research findings to the environmental scientific community. This document reflects the Ministry's commitment to environmental research through effective allocation of resources in a manner consistent with Ministry policies and priorities.

The inventory presents summaries of research projects funded by the Ministry and in progress during 1990. It includes research grants and contracts to universities, consultants and other external research institutions and agencies, as well as internal research projects. The summaries are reported according to the sponsoring committee, Branch or Region as follows:

- Research Advisory Committee
- Air Resources Branch
- Hazardous Contaminants Coordination Branch
- Laboratory Services Branch
- Waste Management Branch
- Water Resources Branch
- Regions
- Ontario Pesticides Advisory Committee

The budget and resources information provided reflects only the originally approved allocations.

Further information pertaining to any of the projects may be obtained by contacting the principal investigator or the project liaison officer. Information about the Ministry's Environmental Research Program can be obtained from:

Research and Technology Branch  
Ontario Ministry of the Environment  
135 St. Clair Avenue West, 9th Floor  
Toronto, Ontario  
M4V 1P5

Telephone: (416) 323-4574

RESEARCH ADVISORY COMMITTEE

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RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X	Contract X	Solicited
INTERNAL	Grant	Unsolicited X

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PROJECT TITLE:	Slow Sand Filtration for Production of Drinking Water in Small Northern Communities	PROJECT NO:	296C
		START DATE:	11/86

---

SHORT TITLE: Slow Sand Filtration

---

PRINCIPAL INVESTIGATOR AND AFFILIATION: W.J. Hargrave, P. Eng.  
Gore & Storrie Limited

---

LIAISON OFFICER (name, location, telephone no.): J. Dart  
Water Resources Branch  
323-4876

---

OBJECTIVE(S): To investigate the design, operation and maintenance of slow sand filtration for the treatment of drinking water in small northern communities.

---

PROJECT DESCRIPTION:

1. To assemble design, operation, maintenance and cost information on slow sand filtration through laboratory and on-side studies.
2. To evaluate simple chemical dosing systems, the potential colour removal, and to operate pilot test site.

Successful completion of the study will provide information on design and operation of slow sand filtration systems with particular reference to colour removal.

---

BUDGET AND RESOURCES:	Year: (* current)	4	5*	6	TOTAL
	Cost: (\$000's):				150.0
	Work Years:				

---

Budget Source: RAC

---

KEYWORDS: slow sand filtration, design, operation, maintenance cost, chemical dosing, colour removal

---

OUTPUT (papers, presentations, reports): Paper presented at the Technology Transfer Conference 1987.

---

EXTERNAL PARTICIPATION (ministries, governments, agencies):

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COMMENTS:

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).



RESEARCH AND TECHNOLOGY INVENTORY: 1989

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

---

PROJECT TITLE: Clay/Leachate Compatibility Study	PROJECT NO: 299C
Hydraulic Conductivity of Ottawa-Carleton "Leda" Clay	START DATE: 03/87
Barrier Soils Permeated with Domestic Waste Leachate	

---

SHORT TITLE: Domestic Leachates

---

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. R.M. Quigley,  
Director of Geotechnical  
Research Centre  
University of Western  
Ontario

---

LIAISON OFFICER (name, location, telephone no.): R. Dunn  
MOE (SE Region)  
(613) 521-3450

---

OBJECTIVE(S): To assess the compatibility of four Leda Clay samples (from the Ottawa-Carleton region) with typical domestic waste leachate. The work would be used as input for environmental hearings associated with selection of future landfill sites on leda clay. The work was requested by MacLaren Engineers at the request of the Ontario Ministry of the Environment.

---

PROJECT DESCRIPTION:

Four "typical" Leda clay samples would be supplied by Golder Associates (Ottawa) under the supervision of MacLaren Engineers. These samples would be subjected to permeation by domestic waste leachate to assess any changes in hydraulic conductivity. Extensive chemical analyses of both the influent and effluent liquids would indicate any retardation of selected soluble species.

---

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	25.0			25.0
	Work Years:	0.4			0.4

---

Budget Source: RAC

---

KEYWORDS: Ottawa-Carleton Leda Clays, hydraulic conductivity, permeation, domestic leachate, soluble chemical retardation

---

OUTPUT (papers, presentations, reports):

---

EXTERNAL PARTICIPATION (ministries, governments, agencies):

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COMMENTS: Report submitted to Liaison Officer on August 2, 1988 for Review.

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

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PROJECT TITLE: Slow Rate Infiltration Land Treatment and Recirculation of Landfill Leachate in Ontario	PROJECT NO: 333G START DATE: 04/87
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---

SHORT TITLE: Recirculation of Leachates

---

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. R.A. McBride  
Land Resource Science  
University of Guelph

---

LIAISON OFFICER (name, location, telephone no.): A. Oda  
Waste Management Branch  
323-5129

---

OBJECTIVE(S):

1. To evaluate slow rate infiltration land treatment of leachate in forest/agricultural areas.
  2. To evaluate recirculation of leachate as partial treatment.
- 

PROJECT DESCRIPTION:

This is a three-year research study which will achieve the above objectives through the establishment of pilot-scale installations and the implementation of perturbation experiments at four sites across Ontario. Intensive characterization and monitoring of the more important biotic and abiotic ecosystem components will be carried out. Landfill recirculation will also be investigated as a means of pretreatment prior to slow rate infiltration land application, by lessening both leachate volume and strength.

---

BUDGET AND RESOURCES:	Year: (* current)	4	5	6*	TOTAL
	Cost: (\$000's):	171.2	147.8	128.4	447.4
	Work Years:	6			

---

Budget Source: RAC

---

KEYWORDS: leachate treatment, land application, recirculation, soil infiltration, irrigation (spray, trickle, sub-surface), effects on vegetation

---

OUTPUT (papers, presentations, reports):  
Paper presented at the Technology Transfer Conference 1987 & 1988.

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EXTERNAL PARTICIPATION (ministries, governments, agencies):

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COMMENTS:

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

Contract X  
Grant

Solicited  
Unsolicited X

PROJECT TITLE: Development of the Backfill and  
Construction Application Guidelines - Phase II

PROJECT NO: 336C  
START DATE: 04/87

SHORT TITLE: Backfill Guidelines

PRINCIPAL INVESTIGATOR AND AFFILIATION: M. Kellcher  
Project Manager  
CANVIRO Consultants Ltd.

LIAISON OFFICER (name, location, telephone no.): R. Dalrymple  
Waste Management Branch  
323-5211

OBJECTIVE(S):

To identify Ontario sites where industrial waste has been/is being used as backfill, to carry out a comprehensive study of the impact; to assess changes with time; to assess draft guidelines developed in Phase I.

PROJECT DESCRIPTION:

Phase II work will primarily involve detailed bulk quality characterization and leachate testing of backfill material from selected sites, as well as site hydrogeologic investigations and the uses of these data in the criteria assessment exercise. In addition, changes to the Phase I work as per previous discussions will also be included in the Phase II work.

BUDGET AND RESOURCES:	Year: (* current)	1	2*	3	TOTAL
	Cost: (\$000's):	21.9	173.1		195.0
	Work Years: 2				

Budget Source: RAC

KEYWORDS: inert fill guidelines, landfill testing, quality evaluation

OUTPUT (papers, presentations, reports): 1. MOE Guideline on the Use of Waste Materials in Construction Backfill Applications (pending resolution of overall policy on materials management). 2. Potential paper & presentations at conferences on subject of "Waste as Backfill".

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: Final report expected by Fall '90 but action regarding findings and a backfill guideline must await resolution of the materials policy initiative.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X                      Contract                      Solicited  
INTERNAL                      Grant        X                      Unsolicited    X

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PROJECT TITLE: In Situ Determination of Fecal Indicator Bacteria Survival in Agriculturally Impacted Watersheds                      PROJECT NO: 344G  
START DATE: 11/87

---

SHORT TITLE: Watershed Indicator Bacteria

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PRINCIPAL INVESTIGATOR AND AFFILIATION: M. Walters  
Lake Simcoe Conservation Authority

LIAISON OFFICER (name, location, telephone no.): W. Lammers  
Central Region  
467-3018

---

OBJECTIVE(S): 1. To document and investigate the seasonal variations in bottom sediments and water columns, including the environmental factors that may influence bacterial survival.  
2. To provide bacterial survival data required to develop a transport model and to assess the contribution of individual inputs from agricultural sources on beaches.

---

PROJECT DESCRIPTION: Development of hydrologic transport model to establish the potential boundaries and impact of a source(s) on beach areas. The identification of sources that affect the water quality of beach areas is required for successful targeting of remedial efforts. Successful completion of this study will provide the Lake Simcoe Region and Metro Toronto and Region Conservation Authorities with the bacterial survival information required for input into pollution transport models and the completion of pollution control plans.

---

BUDGET AND RESOURCES:	Year: (* current)	1	2	3*	TOTAL
Cost: (\$000's):		61.0	67.5	35.5	164.0
Work Years:					

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Budget Source: RAC

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KEYWORDS: bacteria, survival, transport, source contributions

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OUTPUT (papers, presentations, reports): Poster Session at Technology Transfer Conference 1989. Results of the study were requested by the following agencies:

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Conservation Authorities

Niagara Region Conservation Authority  
Otonabee Region Conservation Authority  
Grey Sauble Region Conservation Authority  
Rideau Valley Conservation Authority  
Grand River Conservation Authority  
Maitland Valley Conservation Authority  
Ausable Bayfield Conservation Authority  
Essex Region Conservation Authority  
St. Clair Region Conservation Authority  
Halton Region Conservation Authority  
Upper Thames River Conservation Authority

OUTPUT (papers, presentations, reports): Cont'd.

Ministry of the Environment

MISA Section (J. Antoszek)  
Central Region (S. Maude)  
Southwestern Region (G. Palmateer)

Colleges and Universities

University of Toronto  
University of Guelph  
Centralia College

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EXTERNAL PARTICIPATION (ministries, governments, agencies):

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COMMENTS: The field work of this study is completed; the draft report is still under preparation. This contract is presently being finalized.

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL  
INTERNAL X

Contract X  
Grant

Solicited  
Unsolicited X

PROJECT TITLE: Development of Ambient Air Monitoring  
Methodologies for Dioxins and Furans

PROJECT NO: 346C  
START DATE: 11/87

SHORT TITLE: Dioxin/Air Monitoring

PRINCIPAL INVESTIGATOR AND AFFILIATION: R. Clement  
M. Lusia  
C. Tashiro  
P. Steer (MOE)  
C. Chiu  
T. Dann, Environment Canada

LIAISON OFFICER (name, location, telephone no.): T. Dann  
Environment Canada  
(613) 991-9459

OBJECTIVE(S): (1) To validate and document designs for filtration/sorbent  
hi-volume sampling and analysis of dioxins and furans in ambient air filter  
and PUF samples. (2) To utilize the developed method for obtaining dioxins  
and furans data at selected locations and use the data to establish QA/AC  
procedures for air sampling and analysis.

PROJECT DESCRIPTION: (1) To review current activities including data bases.  
(2) To evaluate air sampling and analysis procedures and carry out related  
intercomparison study. (3) To discuss the developed technologies at a  
special workshop and apply them to specific areas. (4) To identify qualified  
laboratories capable of performing future work and their certification.

This study is jointly funded by Ontario, B.C., Alberta and Environment Canada.  
Successful completion of the research will provide the proponents with a  
state-of-the-art technology on dioxin and furans in air.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	4*	TOTAL
Cost: (\$000's):		30.0	45.0	10.0	30.0	115.0
Work Years:	4					

Budget Source: RAC/EC/BC

KEYWORDS: Filtration/sorbent, QA/QC procedures, dioxins, furans

OUTPUT (papers, presentations, reports): Paper presented at the Symposium on  
Measurement of Toxic Related Air Pollutants, North Carolina, 1988; 2 papers at  
Dioxin '89. 2 papers submitted to Chemosphere; Workshop Proceedings in  
preparation.

EXTERNAL PARTICIPATION (ministries, governments, agencies): Joint funding  
with the province of B.C. and Environment Canada. Sponsored by CCME Research  
Advisory Committee.

COMMENTS: Budget for Year 4 carried over from Year 3.

NOTE: "External" refers to projects carried out by investigators outside the  
Ministry. Please indicate budget source by organization (e.g., RAC,  
OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

Contract  
Grant X

Solicited  
Unsolicited X

---

PROJECT TITLE: Development of a Hydrologic Model to Predict the Environmental Fate of De-icing Salts      PROJECT NO: 356G  
START DATE: 02/88

---

SHORT TITLE: Hydrologic Model/De-icing Salts

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PRINCIPAL INVESTIGATOR AND AFFILIATION: K.W.F. Howard  
University of Toronto

LIAISON OFFICER (name, location, telephone no.): G. Soo Chan  
Water Resources Branch  
323-4890

---

OBJECTIVE(S): To develop a hydrologic salt and water balance model that will predict, on a catchment scale, the long-term environmental fate of many tens of thousands of tonnes of road de-icing chemicals applied annually to Ontario's highways, streets, paths and sidewalks. Essential features of this model include as follows: 1) It will be based on sound hydrologic principles and incorporate recent developments in our understanding of overland and shallow sub-surface contaminant flow processes (including mixing and ion exchange); 2) It will consider application of both NaCl and CaCl<sub>2</sub> and be concerned with the fate of Na and Ca, as well as Cl; 3) It will be developed for a specific catchment(s), but will be sufficiently versatile and flexible for use in other catchments; 4) It will predict long-term chemical changes of water quality in groundwaters, lakes and rivers; 5) It will be developed for ease of use with the eventual user in mind.

---

PROJECT DESCRIPTION: The study is phased over 3 years and, while primarily desk-oriented, will involve elements of field and laboratory investigation. Primary elements include: a) acquisition and critical assessment of all available and existing methodologies for catchment salt balance calculations; b) development of salt/water balance catchment model incorporating both new and existing technologies; c) selection of a catchment suitable for model testing and calibration; d) acquisition of baseline data pertinent to selected study catchment(s); e) acquisition of additional input data through field and laboratory study; f) testing and calibration of the new model; g) preparation of the final report.

---

BUDGET AND RESOURCES:	Year: (* current)	1	2	3*	TOTAL
	Cost: (\$000's):	31.9	33.4	33.4	98.7
	Work Years: 3				
Budget Source: RAC					

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KEYWORDS: de-icing salts, environmental fate, hydrologic salt and water balance model

---

OUTPUT (papers, presentations, reports): 1989 Technology Transfer Conference: Paper presented. Hydrologic Model of De-icing Salts in the Environment- A Salt Balance in an Urban Watershed.

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EXTERNAL PARTICIPATION (ministries, governments, agencies):

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COMMENTS:

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).



RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

Contract  
Grant X

Solicited  
Unsolicited X

PROJECT TITLE: Solid Phase Extraction of PAH's from  
Drinking Water and Analysis of Chlorophenols and  
Phenoxy-acid Herbicides in Water

PROJECT NO: 376G  
START DATE: 11/87

SHORT TITLE: Drinking Water/Hydrocarbon Removal

PRINCIPAL INVESTIGATOR AND AFFILIATION: B. Craig  
Paracel Laboratories Ltd.

LIAISON OFFICER (name, location, telephone no.): D. Hall  
Laboratory Services Branch  
235-5910

OBJECTIVE(S): (1) To determine the feasibility of using Solid Phase Extraction (SPE) in the analysis of polynuclear aromatic hydrocarbons (PAH's) in water. (2) To complete the work conducted previously as a feasibility study on the solid phase extraction of chlorophenols and phenoxy-acids so that this methodology may be adopted as a routine procedure by the Ministry and to improve the derivatization and clean-up procedures for these compounds.

PROJECT DESCRIPTION: The feasibility study of solid phase extraction of PAH's will include:

- an in-depth critical review of the literature;
- selection of the best solid phase;
- selection of the best supplier;
- determination of the stability of lots;
- investigation of methods to reduce interferences;
- determination of recoveries;
- application to real samples; and
- determination of the stability of adsorbates.

The project on analysis of chlorophenols and phenoxy-acid herbicides involves fine-tuning the existing methodology for the solid phase extraction of chlorophenols and phenoxy-acid herbicides from water. This work will decrease the levels of interferences in these samples and examine the parameters that affect the reproducibility and accuracy of the methodology. Also, a variety of derivitization procedures for the characterization of these compounds will be studied.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3*	TOTAL
Cost: (\$000's):					100.0
Work Years: 3					

Budget Source: RAC

KEYWORDS: solid phase extraction, water, polynuclear aromatic hydrocarbons (PAH's), chlorophenols, phenoxy-acid herbicides, method optimization

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: A final report has been accepted, the project will be implemented in the Laboratory Services Branch.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).



RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

Contract  
Grant X

Solicited  
Unsolicited X

PROJECT TITLE: Hamilton Air: Chemical Composition  
and Genotoxic Activity of Respirable Particulate  
and Organic Vapours

PROJECT NO: 386G  
START DATE: 01/88

SHORT TITLE: Air Quality/Hamilton

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. D. Macalla  
McMaster University

LIAISON OFFICER (name, location, telephone no.): D. Corr  
West Central Region  
521-7705

OBJECTIVE(S): Determine what levels of airborne mutagenicity can be detected on respirable particles in the Hamilton airshed as a function of season and meteorological conditions. Determine if a simple mammalian index of genotoxic hazard can be developed using a post labelling technique which permits the quantitation of DNA adducts formed with activated carcinogens. Determine what chemical classes contribute to the mutagenicity of Hamilton air. Determine how total airborne mutagenicity related to the air quality index.

PROJECT DESCRIPTION: Preparation of reference sample by extraction of air particulate samples collected by D. Pengelly, et al. Fractionation of reference sample and characterization of fractions for mutagenicity in the Ames/Salmonella assay. Testing of mutagenic PAH fractions for DNA adduct formation using the <sup>32</sup>P-postlabelling assay with bacteria and/or rabbit tracheal cells. Chromatographic analysis of PAH fractions derived from reference sample. Designation of tracers for source apportionment. Initial collections of respirable air particulate samples from three locations in Hamilton.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3*	TOTAL
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Cost: (\$000's):					130.0
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Work Years: 3					
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Budget Source: RAC

KEYWORDS: airborne mutagenicity, respirable particles, air quality index, AMES test, rabbit tracheal cells

OUTPUT (papers, presentations, reports):

TTC 1988 (November), presented: "Hamilton Air: Chemical Composition and Genotoxic Activity of Respirable Particulate and Organic Vapours".  
TTC 1989 (November), presented: "Genotoxic Compounds Associated with Respirable Urban Air Particulate - Chemical Fractionation and Bioassay of Complex Mixtures".

Fifth International Conference on Environmental Mutagens: Symposium on Basic Mechanisms of Mutation. July 10-15, 1989. York.

University ; Toronto, Ontario Poster Presentation. INCREASED GENOTOXIC SENSITIVITY OF S. Typhimurium STRAINS TO NITRO PAH METABOLISM IS RELATED TO ENZYMATIC ACTIVATION NA DTO INCREASED DNA ADDUCT FORMATION.

OUTPUT (papers, presentations, reports): Cont'd

The Twelfth International Symposium on Polynuclear Aromatic Hydrocarbons.  
Gaithersburg, Md., September, 1989. Poster Presentation.

CHEMICAL FRACTIONATION AND BIOASSAY OF COMPLEX MIXTURES.

The annual meeting of the Environmental Mutagen Society, March 25-29, 1990;  
Albuquerque, New Mexico. Two Poster Presentations.

- (1) GENOTOXIC COMPOUNDS ASSOCIATED WITH RESPIRABLE PARTICULATE AND OIL EMISSIONS FROM A TIRE FIRE. CHEMICAL FRACTIONATION AND BIOASSAY OF COMPLEX MIXTURES.
- (2) GENOTIXIC COMPOUNDS ASSOCIATED WITH RESPIRABLE PARTICULATE AND OIL EMISSIONS FROM A TIRE FIRE. CHEMICAL FRACTIONATION AND BIOASSAY OF COMPLEX MIXTURES.

The Mutagenicity Gathering for Quebec and Southern Ontario held at York University; May 31, June 1, 1990.

Rostrum Presentation: MUTAGENICITY OF ORGANIC ASSOCIATED WITH URBAN AIR PARTICULATE.

Poster Presentation: CHARACTERIZATION OF SENSITIVE STRAINS OF S. typhimurium USED FOR DETECTION OF MUTAGENS IN URBAN AIR PARTICULATES.

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EXTERNAL PARTICIPATION (ministries, governments, agencies):

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COMMENTS: In progress.

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

Contract  
Grant X

Solicited  
Unsolicited X

PROJECT TITLE: Partial Support of a Collection of  
Algal, Microbial and Plant Cell Cultures

PROJECT NO: 387G  
START DATE: 02/88

SHORT TITLE: Algal, Microbial and Plant Cell

PRINCIPAL INVESTIGATOR AND AFFILIATION: P. Stokes  
University of Toronto

LIAISON OFFICER (name, location, telephone no.): K. Nicholls  
Water Resources Branch  
235-5810

OBJECTIVE(S): To develop and maintain a research collection of microorganisms (algae, cyanobacteria, selected bacteria) and higher plant cells which will be used extensively in research on environmental science, environmental engineering, algal physiology and ecology and plant biotechnology (including algae and higher plants). To provide a resource centre for plasmid vectors and plasmid-borne clone banks constructed from photosynthetic organisms and gene-specific cloned DNA to be used as probes. To create and implement an information network for researchers to provide computer access to this collection and link with other culture collections.

PROJECT DESCRIPTION: The University of Toronto Culture Collection is a facility of the Institute for Environmental Studies and the Department of Botany and was initiated in late 1986 with a one-year grant from the Ontario Ministry of Colleges and Universities Excellence Fund. At present, about 150 isolates of algae and cyanobacteria are being cultured, including 30 isolates from acidified, organically or metal polluted waters. We anticipate that at full capacity the UTCC will be maintaining about 1000 isolates. As far as possible the cultures will be maintained in axenic condition and in defined media, as is required for most research applications. The Ministry of the Environment will have access to this culture collection.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3*	TOTAL
	Cost: (\$000's):	12.0	12.0	12.0	36.0
	Work Years: 3				

Budget Source: RAC

KEYWORDS: culture collection, algae, cyanobacteria, bacteria, higher plant cells, plosmids, environmental research, ENA probes

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

Contract X  
Grant

Solicited X  
Unsolicited

PROJECT TITLE: Sampling of Biomedical Waste  
Incinerators

PROJECT NO: 388C  
START DATE: 02/88

SHORT TITLE: Waste Incineration/Biomedical Waste Incinerators

PRINCIPAL INVESTIGATOR AND AFFILIATION: Shekar Viswanathan  
Clayton Environmental  
Consultants

LIAISON OFFICER (name, location, telephone no.): V. Oztvacic  
Air Resources Branch  
440-3559

OBJECTIVE(S): Perform stack sampling at ten biomedical waste incinerators. Using separate sampling trains, collect stack samples for the following analyses: a) particulates, trace metals and hydrogen chloride, b) trace organic species - PAHs, PCDDs, PCDFs, PCBs, chlorobenzenes, and chlorophenols, c) volatile organic species such as chloroform, benzene ethylene chloride, d) bacteria, spores and viruses. Record quantities and classifications of wastes and observe incinerator operations during sampling. Weight the ash residue after each batch incineration and prepare a representative sample of this ash for chemical and other analyses and a leachate study. Transport all samples to the Ministry's laboratories. Provide a comprehensive report after completion of this study (including two preliminary reports).

PROJECT DESCRIPTION: The compounds of interest will be determined by employing techniques consistent with the following documents: A method of Measure Emissions of Particulate Matter, Metals and Hydrogen Chloride from Stationary Sources, Environmental Protection service (April, 1985); ASME Protocol Sampling for the Determination of PCDDs, PCDFs, PAHs, PCBs, Chlorobenzenes, and Chlorophenols; Protocol for the collection and analysis of Volatile POHCs using VOST - EPA report 600-8-84-007, (March, 1984); Method 5 Stack Sampling Program for the Determination of Bacteria, Spores and Viruses. In addition, the incinerator operations will be recorded during each sampling period. A preliminary test will be carried out to obtain data for nozzle sizing and derivation of isokinetic sampling parameters. A total of three tests will be conducted on each site for compounds of interest under normal operating conditions.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3*	TOTAL
	Cost: (\$000's):	150.0	250.0		400.0
	Work Years:				

Budget Source: ARB/WMB-ESD

KEYWORDS: biomedical waste, waste management

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies): Paper presented at the Technology Transfer Conference 1988. Interim report - 1990.

COMMENTS: In progress.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

Contract X  
Grant

Solicited  
Unsolicited X

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PROJECT TITLE: Modelling Higher Moments of the  
Concentration Probability Distribution  
(Concentration Fluctuations)

PROJECT NO: 389C  
START DATE: 08/89

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SHORT TITLE: Concentration Fluctuations Modelling

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PRINCIPAL INVESTIGATOR AND AFFILIATION: E. Alp  
Concord Scientific Corp.

LIAISON OFFICER (name, location, telephone no.): P.K. Misra  
Air Resources Branch  
235-5768

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OBJECTIVE(S):

Development of a state-of-the-art model for estimating concentration fluctuation (second moment).

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PROJECT DESCRIPTION:

Literature review of available models and data, implementation of (a) selected model(s) and testing against data; fundamental development work for enhancing the capabilities of the model, investigation of incorporation into the regulatory framework.

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BUDGET AND RESOURCES:	Year: (* current)	1	2*	3	TOTAL
	Cost: (\$000's):	25.0	45.0		70.0
	Work Years:				

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Budget Source: RAC

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KEYWORDS: concentration fluctuation model, concentration probability distribution

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OUTPUT (papers, presentations, reports): Presentation at the Ministry's Technology Transfer Conference, reports and possibly paper.

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EXTERNAL PARTICIPATION (ministries, governments, agencies): No direct involvement by other agencies except that some data are coming from the Alberta Energy Research and Conservation Board.

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COMMENTS: In progress.

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

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PROJECT TITLE: A Study of Geochemical Modification of Groundwater Discharging Into Surface Waters From an Industrial Disposal Site	PROJECT NO: 392G
	START DATE: 04/88

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SHORT TITLE: Groundwater/Industrial Disposal Site

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PRINCIPAL INVESTIGATOR AND AFFILIATION: D.R. Lee  
University of Waterloo

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LIAISON OFFICER (name, location, telephone no.): W. Wager  
Sarnia Regional Office  
(519) 336-4030

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OBJECTIVE(S): The first objective is to determine changes in major ion chemistry during groundwater discharge at a major offshore discharge area in the St. Mary's River near a slag disposal site. The long-term objective is to develop and exercise new methods for assessing the impact of offshore contaminant plumes by providing quantitative data on solute transport and model predictions for a range of geochemical conditions in discharge zones.

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PROJECT DESCRIPTION: The proposed work is a study of groundwater as a source of non-point pollution to surface water. It is now possible to locate offshore zones of groundwater and contaminant discharge using a weighted probe containing temperature and electrical conductance sensors. The probe has been used successfully at both Cape Cod and Sault Ste. Marie. Thus, for the first time it is possible to quantify the geochemical changes that occur during the final metres of groundwater flow into surface waters. At the proposed study site the groundwater has been massively modified by leachate from an adjacent slag dump. Qualitative observation and chemical theory both support the fact that large chemical changes will occur in groundwater discharge environments. However, there has been little quantitative work in this subject. The topic is pertinent because without consideration of this geochemical interface it will not be possible to predict solute fluxes from zones of onshore groundwater contamination to contiguous surface waters.

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BUDGET AND RESOURCES:	Year: (* current)	1	2*	3	TOTAL
	Cost: (\$000's):	16.8	12.3		29.1
	Work Years:				

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Budget Source: RAC

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KEYWORDS: geochemical, contaminant plumes, conductance, leachates, fluxes

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OUTPUT (papers, presentations, reports): Progress Report March 1989.  
Poster Presentation RAC Technology Transfer November 1989. Presentation HABS May 1990 Submitted for consideration. Paper to Science.

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EXTERNAL PARTICIPATION (ministries, governments, agencies):

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COMMENTS: In progress.

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).



RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

PROJECT TITLE: Measuring Groundwater Velocity and Hydrodynamic Dispersion in a Single Fracture in Fractured Shale	PROJECT NO: 393G START DATE: 04/88
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SHORT TITLE: Groundwater/Hydrodynamics, Shale

PRINCIPAL INVESTIGATOR AND AFFILIATION: J.A. Cherry  
University of Waterloo  
LIAISON OFFICER (name, location, telephone no.): G. Hughes  
Waste Management Branch  
323-5216

OBJECTIVE(S): To investigate the relation between the fracture aperture width, 2b, determined from hydraulic tests and tracer experiments, and compare to the true aperture. Develop different field measurement techniques and evaluate for accuracy in predicting groundwater velocity. Determine the relation between the aperture density distribution and hydrodynamic dispersion. To determine whether a stochastic approach will be required to account for macroscopic hydrodynamic dispersion at the local field scale.

PROJECT DESCRIPTION: The University of Waterloo, in a study funded by the Ontario Ministry of the Environment, has located and characterized a high-permeability fracture zone in a low-permeability fractured shale. High-permeability zones such as these are common near ground surface in the shales of southern Ontario and can provide important pathways for contaminant migration. Recent evidence from the University of Waterloo study and other work has suggested that there is considerable uncertainty in the accuracy of predictions of groundwater velocity along such fracture planes. To investigate this, the University proposes to characterize the fracture zone at the Waterloo study site in considerably more detail and with a view to developing new hydraulic and tracer testing techniques for more accurately determining the parameters necessary for predicting groundwater velocity. To assess the newly developed and existing techniques, velocity predictions based on the results of the site characterization will be compared to the results of a natural gradient tracer experiment in which the actual groundwater velocity will be measured. In addition, physical inspection of the fracture plane surfaces will be undertaken to aid in the comparison of results. As a result of the findings, the University hopes to provide recommendations or guidelines for the use of hydraulic testing techniques in fractured shale.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3*	TOTAL
	Cost: (\$000's):	40.0	40.0	40.0	120.0
	Work Years:				
Budget Source: RAC					

KEYWORDS: groundwater velocity, fracture planes, improved measurement, prediction

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: In Progress.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

Contract  
Grant X

Solicited  
Unsolicited X

PROJECT TITLE: Tillage and Event Based Soil and  
Phosphorus Loss

PROJECT NO: 396G  
START DATE: 04/88

SHORT TITLE: Soil/Tillage Systems

PRINCIPAL INVESTIGATOR AND AFFILIATION: R. Kachanoski  
University of Guelph

LIAISON OFFICER (name, location, telephone no.): J. Eddie  
Water Resources Branch  
323-4821

OBJECTIVE(S): To determine the effect of tillage systems (conventional, minimum, no-till) on phosphorus/soil loss and associated enrichment ratios for three representative soils (sandy, silt and clay loam). To determine seasonal variation in phosphorus and soil losses on different landscape positions with simulated rainfall. To determine annual phosphorus and soil losses from soil landscapes for natural precipitation events. To establish linkages between plot scale and landscape scale phosphorus and soil loss data for different tillage systems.

PROJECT DESCRIPTION: A study is proposed to obtain information on the seasonal variation of sediment and phosphorus loss for different tillages, landscape positions, and soil type combinations using rainfall simulation and natural precipitation events. The project will make use of existing tillage treatments and soil information being collected in the provincial Tillage-2000 program. Three tillage systems (conventional, minimum, and no-till) will be monitored on sand, silt, and clay loam soils. Two rainfall intensities will be simulated. The project will compare seasonal changes in sediment and P loss data from the microplots to an average annual value being estimated for the sites using cesium-137 as a natural tracer. The study will establish linkages between plot scale and landscape scale phosphorus and sediment loss data which can be used in an event based sediment transport model.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3*	TOTAL
	Cost: (\$000's):	67.5	67.5	67.5	202.5
	Work Years: 3				

Budget Source: RAC

KEYWORDS: tillage systems, landscape positions, precipitation,  
phosphorus/soil loss

OUTPUT (papers, presentations, reports): Progress Report August 1989.  
2nd Progress Report May 1990.

EXTERNAL PARTICIPATION (ministries, governments, agencies): Progress is  
monitored by the Canada-Ontario Agreement Non-point Source Committee.

COMMENTS: In progress.

NOTE: "External" refers to projects carried out by investigators outside the  
Ministry. Please indicate budget source by organization (e.g., RAC,  
OPAC, Branch, etc.).



RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

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PROJECT TITLE: An Integral Model Study of the Airborne Chemical Contaminants from Chemical Plants and Research Buildings: Their Detection, Identification and a Proposed Method for Their Elimination

PROJECT NO: 400G  
START DATE: 04/88

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SHORT TITLE: Airborne Contaminants/Model Study

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PRINCIPAL INVESTIGATOR AND AFFILIATION: C. Depew  
Queen's University

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LIAISON OFFICER (name, location, telephone no.): R. Chapman  
Air Resources Branch  
326-1659

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OBJECTIVE(S): To establish an integral model on a total study of some airborne contaminants originated from typical chemical plants and laboratories in Ontario. The model will select two typical classes of air pollutants: nitrogen oxides (inorganics) and substituted aromatic and polyaromatic hydrocarbons (organic). The overall model study involves the establishment of sampling and detection procedures, and the development of a new method for the elimination of the contaminants from air.

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PROJECT DESCRIPTION: Document and review of existing sampling/detection technologies; defining procedures for air sampling from the exhaust air originating from the Queen's University research buildings. Experimental set-up of a time-averaged dual laser-fluorescence spectrometrical measurement technique for simultaneous measurement of nitrogen oxides and selected polyaromatic and substituted aromatic hydrocarbons. Proposal and design of a microwave-filtering device/technique for the removal/elimination of airborne contaminants from air samples collected and defined by previous studies.

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BUDGET AND RESOURCES:	Year: (* current)	1	2	3*	TOTAL
	Cost: (\$000's):	33.1	33.1	37.8	104.0
	Years:	2.0	2.0	2.5	6.5

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Budget Source: RAC

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KEYWORDS: chemical buildings, airborne contaminants, air filters, microwave catalyzed destruction, microwave chemical reactor

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OUTPUT (papers, presentations, reports): Two papers accepted for publication one in the Journal of Microwave Power, the other in Research on Chemical Intermediates. One presentation at the 11th Canadian Symposium on Catalysis in Halifax, July 1990.

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EXTERNAL PARTICIPATION (ministries, governments, agencies): None

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COMMENTS: In progress.

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

Contract  
Grant X

Solicited  
Unsolicited X

PROJECT TITLE: Atmospheric Measurements of Natural Hydrocarbons Using Gas Chromatograph/Mass Spectrometry PROJECT NO: 401G  
START DATE: 04/88

SHORT TITLE: Hydrocarbons/Atmospheric Measurements

PRINCIPAL INVESTIGATOR AND AFFILIATION: H. Niki  
York University

LIAISON OFFICER (name, location, telephone no.): R. Bell  
Air Resources Branch  
965-4081

OBJECTIVE(S): To measure, using gas chromatography/mass spectrometry, a number of key volatile organic species, particularly biogenic hydrocarbons in the oxidant/acid rain problem to be compared against model predictions and also to gain a better understanding of atmospheric chemistry in a Canadian setting, as part of the Eulerian Model Evaluation Study.

PROJECT DESCRIPTION: The proposal measurement program will be related to the CIRAC-endorsed Canadian Atmospheric Chemistry Study as part of the Eulerian Model evaluation Field Study. Air samples collected at the Ministry's site at Dorset and other appropriate forested areas will be analyzed by GC/MS in the laboratory mainly for natural hydrocarbons such as isoprene and terpenes. An important component of this program is a critical evaluation and improvement of existing sample collection and handling techniques employed for GC/MS based identification and quantification of these labile compounds.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3*	TOTAL
	Cost: (\$000's):	120.0	68.2	68.2	256.4
	Work Years: 3				

Budget Source: RAC

KEYWORDS: hydrocarbons, volatile organics, atmospheric measurement, natural organics

OUTPUT (papers, presentations, reports): Progress Report May 1989, Paper presented at the Technology Transfer Conference 1988. Progress Report April 1990. A joint paper with Bothenhuin last year (Nov./89).

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: In progress.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

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PROJECT TITLE: Determination of the Dose-Responses for Tissue Contamination and Growth of Vegetable Crops Exposed to Chronic Levels of Organic Environmental Contaminants Originating from Industrial Processes

PROJECT NO: 405G  
START DATE: 04/88

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SHORT TITLE: Organic Contaminants/Dose-Response Study

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PRINCIPAL INVESTIGATOR AND AFFILIATION: D. Ormrod  
University of Guelph

LIAISON OFFICER (name, location, telephone no.): D. Harper  
Air Resources Branch  
456-2504

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OBJECTIVE(S): To establish bioaccumulation of trichloromethane and phenol through foliar exposure at concentration ranges including ambient standards using radish, lettuce and tomato. To establish bioaccumulation of trichloromethane and phenol through contamination of the root zone at a range of concentrations including ambient standards using radish, lettuce and tomato. To assess the relative importance of foliar and root exposures to bioaccumulation of these compounds in plant tissue, and establish partitioning indices as well as dose-response relationships between the two pathways of exposure and tissue accumulation. To assess the phytotoxicity of these compounds by root, foliar, and root and foliar exposure. Phytotoxicity will be evaluated by determining dose-response relationships between growth parameters and contaminant concentrations applied to the growing medium.

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PROJECT DESCRIPTION: The current emphasis on evaluating the environmental hazard of various phytoaccumulation and phytotoxicity exists for a few compounds and a small variety of plants, it is insufficient data to thoroughly predict the impact of industrial contamination on human dietary ingestion, and on growth processes of the plants themselves. Uptake by plants may occur via two pathways, foliar and root; the pathway may influence the eventual concentration of contaminants in edible portions, or the growth effects on different plant parts. The predominant pathway will depend on the medium which is contaminated, although in many situations both soil and air will be part of plant exposure. There is a need for an integrated study which evaluates the effects of chronic concentrations of several contaminants on three vegetable groups (root vegetables, leafy vegetables and fruit vegetables), by comparing the roles of the pathway of exposure on phytoaccumulation in various plant parts, injury and growth suppression. This research will lead to a better understanding of how industrial contaminants are partitioned in the terrestrial environment, leading to better human and eco-risk assessment.

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BUDGET AND RESOURCES:	Year: (* current)	1	2	3*	TOTAL
	Cost: (\$000's):	46.4	30.9	30.9	108.2
	Work Years: 3				

Budget Source: RAC

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KEYWORDS: bioaccumulation, radish, lettuce, tomato, foliar, root zone, partitioning indices, dose-response, phytotoxicity

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OUTPUT (papers, presentations, reports): Progress Report March 1989

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EXTERNAL PARTICIPATION (ministries, governments, agencies):

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COMMENTS:

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

Contract X  
Grant

Solicited  
Unsolicited X

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PROJECT TITLE: An Investigation of Vibration Isolation in a House for Reduction of Train Vibration  
PROJECT NO: 407C  
START DATE: 04/88

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SHORT TITLE: House Isolation/Train Vibration

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PRINCIPAL INVESTIGATOR AND AFFILIATION: J. Rainer  
National Research Council  
Canada

LIAISON OFFICER (name, location, telephone no.): V. Schroter  
Industrial Approvals  
440-3715

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OBJECTIVE(S): To determine the characteristics of ground vibrations from trains at two locations.

To determine the effectiveness of a given vibration method in reducing train-induced vibrations in a test house.

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PROJECT DESCRIPTION:

This proposal is in 3 parts. Each part is self-contained; however, the parts complement each other, so that a comprehensive investigation into train vibration effects on houses will emerge. Part I consists of evaluating transducer mounting techniques in the ground so that reliable measurements can be assured. Part II characterizes the ground vibrations from trains at 2 locations, and Part III evaluates the effectiveness of a vibration isolation method in a test house.

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BUDGET AND RESOURCES:	Year: (* current)	1	2	3*	TOTAL
	Cost: (\$000's):	11.2	36.9	25.2	73.3
	Work Years: 3				

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Budget Source: RAC

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KEYWORDS:

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OUTPUT (papers, presentations, reports):  
Poster presentation at '89 Technology Transfer Conference.

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EXTERNAL PARTICIPATION (ministries, governments, agencies):

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COMMENTS: In progress.

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL  
INTERNAL X

Contract X  
Grant

Solicited  
Unsolicited X

PROJECT TITLE: Landfill Monitoring Protocol  
Development for Ontario

PROJECT NO: 410C  
START DATE: 04/88

SHORT TITLE: Protocol Development

PRINCIPAL INVESTIGATOR AND AFFILIATION: Hans Mooij  
Waste Management Branch  
(previously with - H. Mooij  
& Associated Ltd.)

LIAISON OFFICER (name, location, telephone no.): G. Hughes  
Waste Management Branch  
323-5216

OBJECTIVE(S): To develop practicable recommendations to the Ministry of the Environment, based on expert consensus positions and documented present practices and procedures, for the development of landfill leachate and groundwater quality monitoring protocols and procedures.

PROJECT DESCRIPTION: The Ministry of the Environment has developed draft guidelines on monitoring landfills. These guidelines specify monitoring objectives and performance rather than methodology. The research project will document current monitoring practices in Ontario and other jurisdictions. This will be the basis of a background document which will serve as the subject for a round-table discussion between selected experts in the field of landfill monitoring in order to develop consensus positions on all aspects of monitoring program protocols, procedures and practices. Particular attention will be paid to the merits of establishing guidelines that specify acceptable and required monitoring methodology.

This research approach will be assessed with respect to its applicability in the development of other Ministry guidelines.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3*	TOTAL
	Cost: (\$000's):				21.6
	Work Years:				

Budget Source: RAC

KEYWORDS: landfill leachate, groundwater, monitoring procedures  
recommendations, expert consensus

OUTPUT (papers, presentations, reports): Progress report 1988. Final report completed on first phase of work, November 1989.

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: As H. Mooij is now on staff, it is planned to complete the work in house.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

Contract X  
Grant

Solicited  
Unsolicited X

PROJECT TITLE: Glassification and Leachability of  
Hazardous Waste Residues

PROJECT NO: 411C  
START DATE: 04/88

SHORT TITLE: Glassification

PRINCIPAL INVESTIGATOR AND AFFILIATION: K.B. Harvey  
Atomic Energy Research  
Laboratories

LIAISON OFFICER (name, location, telephone no.): G. Castonguay  
Waste Management Branch  
323-5214

OBJECTIVE(S): To make a first estimate of the value of immobilizing hazardous waste materials and residues in a silicate glass matrix. If the resulting concentrations or rates of release into simulated groundwaters are significantly reduced when compared with conventional methods for immobilization, this could form the basis for the development of low- or controlled-release waste forms, and of novel means for the treatment and disposal of hazardous wastes.

PROJECT DESCRIPTION: A simulated hazardous waste residue will be immobilized in a soda-lime silicate glass under conditions that will simulate several waste types, and immobilization routes. Complete chemical analyses of the starting materials and of the completed waste forms will be made in order to determine the effect of different treatment routes on any loss of volatile metals. Release from the waste forms into water or simulated leachate will be measured both by the standard leachate extraction procedure, and by an extended dynamic test, at 20 to 25°C, and at 10°C to simulate an average year-round ground temperature. Release from the waste forms will be followed both by chemical analysis of the leachants, and by the addition of radioactive tracers.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3*	TOTAL
	Cost: (\$000's):	15.0	31.0	15.8	61.8
	Work Years: 3				

Budget Source: RAC

KEYWORDS: hazardous wastes, groundwater, immobilization, glassification, leachability

OUTPUT (papers, presentations, reports): Interim Reports (August 1988, February 1989, July 1989), presentation (C14) at the Technology Transfer Conference (November 20, 1989), Draft Final Report (February 1990).

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: Final report to be completed by Fall 1990.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).



RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

Contract X  
Grant

Solicited X  
Unsolicited

PROJECT TITLE: Chlorinated and Nonchlorinated  
Organics Storage Studies

PROJECT NO: 412C  
START DATE: 04/88

SHORT TITLE: Organic Storage Studies

PRINCIPAL INVESTIGATOR AND AFFILIATION: Neaves  
Enviroclean

LIAISON OFFICER (name, location, telephone no.): Patrick W. Crozier  
Laboratory Services Branch  
235-5910

OBJECTIVE(S): The main objective of the proposed study is to provide the ministry with a manual documenting the maximum storage times and conditions for which organic samples may be kept before analytical results become invalid. The project should include: Conducting a comprehensive literature review of the stability of organic compounds during storage of environmental samples, contacting other agencies such as the United States Environmental Protection Agency, Environment Canada, Canada Centre For Inland Waters, and Academic Researchers, to obtain unpublished and internal reports on the stability of organics in stored samples. Recommending storage times/conditions for organics monitored by MOE in various matrices including water, effluents, soils/sediments, air, vegetation and biota. Identifying areas in which additional research on the storage times and conditions for organic substances is needed.

PROJECT DESCRIPTION: Phase I - Literature Review - In this phase of the project a comprehensive and critical literature review of published stability/storage studies for organic compounds currently monitored by Ministry of the Environment organic analyses sections would be undertaken. Agencies such as the United States Environmental Protection Agency (USEPA), Environment Canada, Canadian Centre for Inland Waters (CCIW), and others identified by MOE staff should be contacted for unpublished/internal reports as well as the normal search procedures. Due to the enormous scope of the literature review, further discussion of priorities with ministry staff will be necessary. The effect of storage conditions, storage time, and matrix on compound degradation (or in some cases compound production) should be highlighted.

BUDGET AND RESOURCES:	Year: (* current)	1	2*	3	TOTAL
	Cost: (\$000's):	42.0	5.0		47.0
	Work Years: 2				

Budget Source: RAC

KEYWORDS: organics, storage, water, effluents, air, soils, vegetation, biota

OUTPUT (papers, presentations, reports): 2 volume manual expected entitled "Chlorinated and Non-Chlorinated Organics Storage Studies; and a presentation at 1989 MOE Technology Transfer Conference.

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

Contract X  
Grant

Solicited  
Unsolicited X

PROJECT TITLE: Solid Phase Extraction of Triazines  
and Organophosphorus Compounds from Water

PROJECT NO: 413C  
START DATE: 04/88

SHORT TITLE: Phase Extraction/Phosphorus Compound

PRINCIPAL INVESTIGATOR AND AFFILIATION: W.G. Craig  
Paracel Laboratories Ltd.

LIAISON OFFICER (name, location, telephone no.): D. Hall  
Laboratory Services Branch  
235-5910

OBJECTIVE(S): To determine if the use of solid phase extraction for the  
extraction of triazines and organophosphorus compounds is an appropriate  
analytical procedure, and

Identify which parameters, if any, of the methodology need to be studied  
further, or optimized, before its adoption as a routine analytical technique.

PROJECT DESCRIPTION: The possibility of using the technique of solid phase  
extraction will be examined for the analysis of triazine and organophosphorus  
compounds in water. This feasibility study will include an in-depth  
examination of methods to enhance recoveries and reduce interferences, as well  
as examining the reproducibility of the technique. Parameters to be studied  
include: selection of the best solid phase and eluting solvent, selection of  
the best supplier, determination of the stability of lots, various methods to  
reduce interferences, the consistency of recoveries, application to real  
samples, and the time stability of adsorbates.

BUDGET AND RESOURCES:	Year: (* current)	1	2*	3	TOTAL
	Cost: (\$000's):	50.0	2.5		52.5
	Work Years: 2				

Budget Source: RAC

KEYWORDS: solid phase extraction, water, triazine, organophosphates method  
optimization

OUTPUT (papers, presentations, reports): RAC Final Report & Technology  
Transfer Conference

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: This project is currently in the final states. Final report  
received, results of this project to be implemented in the Laboratory Services  
Branch.

NOTE: "External" refers to projects carried out by investigators outside the  
Ministry. Please indicate budget source by organization (e.g., RAC,  
OPAC, Branch, etc.).



RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

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PROJECT TITLE: Flow Injection Sample Introduction for Inductively Coupled Plasma Atomic Emission and Mass Spectrometry	PROJECT NO: 414G START DATE: 04/88
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SHORT TITLE: FIA for ICP

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PRINCIPAL INVESTIGATOR AND AFFILIATION: Eric D. Salin  
McGill University

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LIAISON OFFICER (name, location, telephone no.): D. Boomer  
Laboratory Services Branch  
235-5858

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OBJECTIVE(S): To generate a sample introduction system for trace level determinations with the following characteristics: 1) Detection limit improvements of at least a factor of 100. 2) Reduction or elimination of matrix effects. 3) Sample throughputs of 30 to 60 per hour. 4) A chemical methodology suitable to a variety of sample types.

Secondary objectives: 1) Automation of sample input using the direct sample insertion device for icp-aes and icp-ms. 2) Feedback from the instrument (or controller) to the sample introduction system so as to provide for intelligent modification of the experiment by either changing the chemistry (select different flow injection system parameters) or handling technique (e.g. standard additions or matrix matching) when justified by "expert" computer analysis of the data. 3) Component speciation.

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PROJECT DESCRIPTION: A high performance sample introduction system based on flow injection techniques will be developed for inductively coupled plasma atomic emission and mass spectrometry. The system should provide detection limit improvement factors of 100 to 10,000 for atomic emission using direct insertion and from 100 to 1,000 for mass spectrometry using direct insertion. The detection limit improvements should be even more dramatic in cases where the matrix causes drastic degradation in detection limits. The flow injection procedure should minimize matrix effects thereby enhancing accuracy. Precisions of approximately 1% are expected.

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BUDGET AND RESOURCES:	Year: (* current)	1	2	3*	TOTAL
	Cost: (\$000's):	46.5	46.5	39.5	132.5
	Work Years: 3				

Budget Source: RAC

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KEYWORDS: ICP, flow injection, ultra-trace, elemental analysis

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OUTPUT (papers, presentations, reports):

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EXTERNAL PARTICIPATION (ministries, governments, agencies):

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COMMENTS: In progress.

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

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PROJECT TITLE: Wildlife Toxicology Fund Projects	PROJECT NO: 417G
	START DATE: 04/88

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SHORT TITLE: Wildlife Toxicology

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PRINCIPAL INVESTIGATOR AND AFFILIATION: Monte Hummel  
World Wildlife Fund Canada

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LIAISON OFFICER (name, location, telephone no.): J. Pagel  
Research & Technology Branch  
323-4576

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OBJECTIVE(S): Wildlife Toxicology Fund (WTF) was established on June 4, 1985 through a Memorandum of Understanding between Environment Canada and World Wildlife Fund Canada. Its purpose is to provide high quality scientific information that can be directly applied to the protection of Wildlife in Canada from irreversible harm caused by toxic chemicals in the environment, and to enhance and develop private sector expertise, and to act as stimulus for the joint funding of research projects. The objective of this proposal is to contribute \$50,000 per year for up to three years to the World Wildlife Fund to fund on a cost shared basis, projects which have been recommended for approval and cost sharing by WWF.

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PROJECT DESCRIPTION: The research priorities of TWF include: Effects of agricultural and/or forestry chemicals on wildlife, effects of toxic industrial pollutants on wildlife, monitoring the success of measures taken to mitigate the effects mentioned in the above two priorities, developing and implementing techniques that use wildlife as indicators of toxic chemicals in the environment, examining environmental pathways by which toxic substances may affect wildlife. Proposals which meet the research priorities of the WTF and are recommended by the RAC will be circulated to the Research Advisory Board of WTF. If approval is obtained from both committees, and if matching funds are in place, a specified amount of MOE's contribution will be released for the project.

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BUDGET AND RESOURCES:	Year: (* current)	1	2	3*	TOTAL
	Cost: (\$000's):	50.0	50.0	50.0	150.0
	Work Years: 3				

Budget Source: RAC

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KEYWORDS:

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OUTPUT (papers, presentations, reports):  
"The Influence of Lake Acidification on Reproductive Success of the Common Loon in Ontario". (1989 Progress Report).  
"Impact of B+ on Chicks of Spruce Grouse, Non-target Insects and Small Birds and Mammals".  
"Effects of Acid Precipitation on Waterfowl: Reproductive effort of common golden eyes in high and low quality habitats."  
"Metabolic Consequences of Environmental Acidification in Fish".

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EXTERNAL PARTICIPATION (ministries, governments, agencies):

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COMMENTS:

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

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PROJECT TITLE: Environmental Valuation Research	PROJECT NO: 418G
	START DATE: 04/88

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SHORT TITLE: Environmental Research

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PRINCIPAL INVESTIGATOR AND AFFILIATION: J. Knetsch  
Simon Fraser University

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LIAISON OFFICER (name, location, telephone no.): O. Salamon  
Policy & Planning Branch  
323-4561

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OBJECTIVE(S): To improve the basis for economic valuation of environmental changes; to investigate assessment and policy implications of the recent findings of large disparities between willingness-to-pay and compensation-demanded measures of economic values; to study preference and choice behaviour of people with respect to alternative environmental policies; to examine various legal sanctions; and to further examine the development and use of economic experiments for research in these areas.

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PROJECT DESCRIPTION: The research will be carried out in a continuing series of individual experimental and survey studies, conducted in part in Ontario. The results of earlier studies will be used to design later empirical efforts, which will take full advantage of the large degree of complementarity among the individual studies. While the Principal Investigator will be responsible for the research, including studies in Ontario, it is anticipated that the Research Assistant and other colleagues will actively participate in expanding the research program.

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BUDGET AND RESOURCES:	Year: (* current)	1	2	3*	TOTAL
	Cost: (\$000's):	24.9	24.5	26.0	75.4
	Work Years: 3				

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Budget Source: RAC

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KEYWORDS: benefit valuation, measuring, non-pecuniary values, willingness-to-pay, compensation-demanded

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OUTPUT (papers, presentations, reports): Presentations at 1988 and 1989 Technology Transfer Conference; Article published by The American Economic Review: "The Endowment Effect and Evidence of Non-Reversible Indifference Curves"

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EXTERNAL PARTICIPATION (ministries, governments, agencies):

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COMMENTS: In progress.

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

Contract  
Grant X

Solicited  
Unsolicited X

PROJECT TITLE: Recycling of Textile Dyebath Effluents PROJECT NO: 421G  
START DATE: 06/88

SHORT TITLE: Textile Dyebath Effluents

PRINCIPAL INVESTIGATOR AND AFFILIATION: Anne Wilcock  
University of Guelph

LIAISON OFFICER (name, location, telephone no.): J. Smart  
Waste Management Branch  
323-5113

OBJECTIVE(S): To test the efficiency of a new, commercially available electrochemical cell in the purification of environmentally hazardous textile dyebath effluents. These effluents contain expensive dyes and other chemicals that, if they can be precipitated from the effluent and reused, represent a substantial economic saving. The colourless supernatant will be tested for biological toxicity and for potential industrial recycling so that manufacturers will have the option of safely discharging the treated effluent to sewers or recycling it in industrial applications.

PROJECT DESCRIPTION: To simulate the recycling of industrial dyebath effluent, an aqueous solution containing one of three common disperse dyes and a biphenyl carrier will be electrochemically separated into dye, carrier and water. The purity and potency of the recovered dyes and carriers will be tested by application to a polyester fabric. The water will be tested for toxicity by fish bioassay, and for reuse potential. The electrochemical separation system will then be tested in actual industrial conditions using disperse and other classes of dyes.

BUDGET AND RESOURCES:	Year: (*current)	1	2	3*	TOTAL
Cost: (\$000's):		18.9	17.6	13.4	49.9
Work Years:	3				

Budget Source: RAC

KEYWORDS: recycling, re-use, textile dye, toxicity

OUTPUT (papers, presentations, reports): Report

EXTERNAL PARTICIPATION (ministries, governments, agencies): None

COMMENTS: In progress.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

PROJECT TITLE: Chemical Exposure Pathways in Ontario	PROJECT NO: 423G
	START DATE: 01/88

SHORT TITLE: Chemical Exposure Pathways

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. D. MacKay  
University of Toronto

LIAISON OFFICER (name, location, telephone no.): J. Smith  
Hazardous Contaminant Branch  
323-5113

OBJECTIVE(S): (1) Establish correspondence between output of environmental model and prevailing concentrations in Ontario. (2) Establish a range of air inhalation and water and food consumption rates for a typical family in Southern Ontario. (3) Develop correlations between concentrations in the environment and those in vegetation, fruit, meat, and dairy products. (4) Quantify human exposure through ambient air, food, and water. (5) Extend assessment to estimation of human physiological fate to chemicals through further development of existing pharmacokinetic model. (6) Validation of the set of models.

PROJECT DESCRIPTION: A multi-media fugacity based environmental model estimates prevailing concentrations in various media such as air, water, soil, sediment, and fish has been developed and validated for a number of chemicals in Southern Ontario. Concepts of this model will be extended to assess exposure to these and additional chemicals by a typical Southern Ontario family through air inhalation and food and water consumption, as well as human physiological distribution and body burden. To quantify these exposures, it will be necessary to (i) establish a range of typical food consumption rates, (ii) develop expressions to correlate concentrations in soil, air, and water with those in vegetation, fruit, meat, and dairy products, and (iii) refine and apply our recently developed pharmacokinetic model. Predicted exposures and body burdens will be compared with those known to cause toxic effects in order to assess their severity.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3*	TOTAL
	Cost: (\$000's):	49.5	43.5	43.5	136.5
	Work Years: 3				
Budget Source: HCCB					

KEYWORDS: air, inhalation, fugacity, water, soil, sediment, fish

OUTPUT (papers, presentations, reports):

In Press:

S. Paterson, D. Mackay "Modelling the distribution of organic chemicals in plants", proceedings of Intermedia Pollutant Transport: Modeling and Field Measurements, UCLA. Aug. 23-26, 1988.

S. Paterson, D. Mackay "A Model illustrating the environmental fate, exposure and human uptake of persistent organic chemicals", Ecological Modelling (in press 1989).

OUTPUT (papers, presentations, reports):

Submitted:

D. Mackay, S. Paterson "Evaluating the regional multimedia fate of organic chemicals: A level III fugacity model", Environ. Sci. Technol.

S. Paterson, D. Mackay, "Review of Evaluative models of environmental fate and human exposure", Reviews in Environmental Toxicology (invited paper).

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EXTERNAL PARTICIPATION (ministries, governments, agencies):

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COMMENTS: In progress.

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

PROJECT TITLE: Monitoring Exposure and Effects of Organic Substances in the Huron-Erie Corridor	PROJECT NO: 424G START DATE: 08/88
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SHORT TITLE: Organic Substances/Huron-Erie Corridor

PRINCIPAL INVESTIGATOR AND AFFILIATION: D. Haffner  
Great Lakes Institute  
University of Windsor

LIAISON OFFICER (name, location, telephone no.): A. Hayton  
Water Resources Branch  
235-5800

OBJECTIVE(S): There are five interactive subprojects: (1) To establish protocols for a statistically sound network of biomonitoring stations in the Huron-Erie corridor. (2) To determine foodweb exposure routes (water or/and in-place pollutants). (3) To calibrate organisms of both the benthic and pelagic food chains in order to determine water and sediment concentrations. (4) To determine if bioaccumulation or bioconcentration regulates residue levels in sport fish. (5) To establish vertebrate monitors to assess the impact of contaminants in the Huron-Erie corridor.

PROJECT DESCRIPTION: 2 sites will be set up along the Huron-Erie corridor to investigate temporal and spatial heterogeneity of contaminants in various media. Three times during the year food web transfers and community structure will be determined at two of the sites. Two benthic organisms will be calibrated to determine influence of sediment uptake. The MOE sport fish data base will be computerized. Impact studies initiated with collection and testing of natural populations. Spatial redundancy corrected by rejecting sites with no significant spatial variability. First foodwebs constructed. Breeding of both brown bullhead and bluntnose minnow populations will be initiated for mutagenicity studies.

BUDGET AND RESOURCES:	Year: (* current)	1	2*	3	TOTAL
	Cost: (\$000's):	200.0	200.0	200.0	600.0
	Work Years: 21				

Budget Source: Environmental Services Division

KEYWORDS: contaminant-monitoring, Huron-Erie Corridor, toxicokinetics, biomonitoring, food-chain

OUTPUT (papers, presentations, reports):

1. "Bioconcentration of chlorinated hydrocarbons in aquatic macrophytes (*Myriophyllum spicatum*)". Env. Sc. Technol.
2. "Mechanism of the biomagnification of hydrophobic organic substances. Environ. Toxicol. Chem.
3. A comparative study of bioconcentration and toxicity of chlorinated hydrocarbons in aquatic macrophytes and fish. ASTM Publication Series.



OUTPUT (papers, presentations, reports): Cont'd

4. "Organic contaminants in food webs: mechanisms, models and management".  
Proceedings, Technology Transfer Conference 1989.
5. "Biocentration of chlorinated aromatic hydrocarbons in aquatic  
macrophytes". 33rd Conf. IAGLR.
6. "Dynamics of organochlorines in wetland habitats". 33rd Conf. IAGLR.
7. "Bioconcentration and toxicity of chlorinated aromatic hydrocarbons in  
aquatic macrophytes". ASTM. San Francisco.
8. "Modelling organic chemical bioaccumulation in the field". 10th Conf.  
SETAC.
9. "Biomonitoring in aquatic ecosystems: patterns and problems."  
Hydrobiologia.

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EXTERNAL PARTICIPATION (ministries, governments, agencies):

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COMMENTS:

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NOTE: "External" refers to projects carried out by investigators outside the  
Ministry. Please indicate budget source by organization (e.g., RAC,  
OPAC, Branch, etc.).



RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

PROJECT TITLE: Behavioural Ecology of the Eastern	PROJECT NO: 427G
Subterranean Termite in Ontario as a Basis for Control	START DATE: 04/89

SHORT TITLE: Termite Behavioural Technology

PRINCIPAL INVESTIGATOR AND AFFILIATION: J.K. Grace  
University of Toronto

LIAISON OFFICER (name, location, telephone no.): G. Cutten  
H.C.C.B.  
323-5117

OBJECTIVE(S): To describe the population demographics and foraging ecology of the eastern subterranean termite, Reticulitermes flavipes (Kollar), in southern Ontario by a systematic examination of colony growth and development, foraging patterns, intercolony interactions, chemically-mediated interactions with vegetation and fungi, and the effect of microclimate on colony development and foraging activities.

PROJECT DESCRIPTION: Select, establish and map field sites. Develop wood extraction, fungal isolation, and bioassay techniques; and establish dye conditions for mark-recapture. Begin mark-recapture study, periodic field collections with evaluation of colony composition, microclimate measurements, and extraction/bioassay of insects, wood and fungi. Complete seasonal mark-recapture study, continue field collections with evaluation of colony composition, and microclimate measurements. HPLC and GC separation of biologically active fractions from trees, associated fungi, and insects eliciting agonistic responses.

BUDGET AND RESOURCES:	Year: (* current)	1	2*	3	TOTAL
	Cost: (\$000's):	30.0	99.1	65.6	194.7
	Work Years: 3				

Budget Source: RAC

KEYWORDS: behaviour ecology, termites, control

OUTPUT (papers, presentations, reports):

Grace, J.K., & A. Abdallay. 1989. Evaluation of the dye marker Sudan Red 7B with Reticulitermes flavipes (Isoptera: Rhinotermitidae). Sociobiology 15:71-77.

Grace, J.K. Northern subterranean termites. Pest Management.

Grace, J.K. A modified trap technique for monitoring Reticulitermes subterranean termite populations (Isoptera: Rhinotermitidae). Pan-Pac. Entomol.

Grace, J.K. Habituation in termite orientation response to fungal semiochemicals. Sociobiology.

OUTPUT (papers, presentations, reports): Cont'd.

- Grace, J.K., A. Abdallay, & K.R. Farr. Eastern subterranean termite foraging territories and populations in Toronto. Can. Entomol.
- Grace, J.K., & G.M. Cutten. Public perceptions of termite control practices in several Ontario (Canada) municipalities. J. Environ. Management.
- Grace, J.K. & A. Abdallay. A short-term dye for marking eastern subterranean termites (Isoptera, Rhinotermitidae). J. Appl. Entomol.
- Grace, J.K. Oral toxicity of barium metaborate to the eastern subterranean termite (Isoptera: Rhinotermitidae). J. Entomol. Sci.
- Grace, J.K. 1990. Mark-recapture studies with *Reticulitermes flavipes* (Isoptera: Rhinotermitidae). Sociobiology 16: 297-303.
- Grace, J.K. 1989. Northern subterranean termites, Pest Management 8(11): 14-16.
- Grace, J.K., & A. Abdallay. 1990. A short-term dye for marking eastern subterranean termites (*Reticulitermes flavipes* Koll., Isoptera, Rhinotermitidae). Journal of Applied Entomology 109: 71-75.
- Grace, J.K. 1990. Oral toxicity of barium metaborate to the eastern subterranean termite (Isoptera: Rhinotermitidae). Journal of Entomological Science 25: 112-116.
- Zoberi, M.H., & J.K. Grace. 1990. Fungi associated with the subterranean termite *Reticulitermes flavipes* in Ontario. Mycologia 82(3): (in press).
- Zoberi, M.H., & J.K. Grace. 1990. Isolation of the pathogen *Beauveria bassana* from *Reticulitermes flavipes* (Isoptera: Rhinotermitidae). Sociobiology 16: 289-296.
- Grace, J.K. 1990. Behavioral ecology of subterranean termites and implications for control. In Current Research on Wood Destroying Organisms and Future Prospects for Protecting Wood in Use (M.I. Haverty & W.W. Wilcox, eds.). (In press).

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EXTERNAL PARTICIPATION (ministries, governments, agencies):

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COMMENTS:

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

PROJECT TITLE: Carcinogenicity Testing of Industrial Effluents Using a Rainbow Trout Assay	PROJECT NO: 429G
	START DATE: 05/89

SHORT TITLE: Carcinogenicity Testing/Industrial Effluents

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. C.D. Metcalfe  
Trent University

LIAISON OFFICER (name, location, telephone no.): Dr. Ian Smith  
Water Resources Branch  
235-5789

OBJECTIVE(S): To develop a carcinogenicity assay using fish which can be used for monitoring of industrial effluents for carcinogenic activity. To fractionate extracts of carcinogenic effluents in order to identify classes of compound which warrant routine monitoring under MISA.

PROJECT DESCRIPTION: To develop techniques for the preparation and fractionation of effluent extracts, using known compounds (e.g. PAH's, PCB's, organohalides, chlorobenzenes, chloroacetones) spiked into simulated effluent matrices. To test combined trout embryo/trout adult exposure protocols using known carcinogens to determine whether tumors can be developed in a short (6 mo.) period. To prepare extracts from representative industrial effluent (e.g. chlorination- stage pulp and paper effluent, coking plant effluent), and to test these extracts for carcinogenicity using the rainbow trout assay protocols developed in year 1. To characterize the organic contaminant concentration of these extracts by analyzing (gas chromatography) for priority organic pollutants. To fractionate the effluents extract giving a positive response in the trout assay using column chromatography, and we will test these fractions for carcinogenicity using the rainbow trout bioassay. We will also analyze the various fractions for priority organic pollutants in order to chemically characterize the extract fractions.

BUDGET AND RESOURCES:	Year: (* current)	1	2*	3	TOTAL
	Cost: (\$000's):	42.9	42.9	42.9	128.7
	Work Years: 3				

Budget Source: RAC

KEYWORDS: waste water management, carcinogenicity testing, rainbow trout assay, mutagenicity testing, effluent

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: Partial funding led to reduction in project scope. Approved by Liaison Officer June 27, 1989.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

Contract  
Grant X

Solicited  
Unsolicited X

PROJECT TITLE: Development of an Expert System for  
Automated Analysis of Metals

PROJECT NO: 432G  
START DATE: 04/89

SHORT TITLE: Development of ACexpert

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. M.J. Stillman  
University of Western Ontario

LIAISON OFFICER (name, location, telephone no.): Dr. J.C. Hipfner  
Laboratory Services Branch  
235-5856

OBJECTIVE(S):

1) To develop a demo Expert System to fully control an AA for metal analysis;  
2) To develop a generic Expert System to monitor and model quality control  
procedures used for data analysis; 3) Investigate use of an Expert System for  
technical personnel training.

PROJECT DESCRIPTION: ACexpert is a very large expert system that comprises a  
number of interacting modules. Each module is itself a sophisticated expert  
system that carries out a specific task. ACexpert provides the link between  
the operation of these individual expert systems, the user, and the hardware  
that is used to complete the analysis. ACcontrol is the module that carries  
out all real-time instrument control functions, it includes an extensive CRT  
user interface and an expert system-based QC program. The other modules  
involve expert system and data base management techniques. The base modules  
for ACexpert will be completed, following the design established during 1987.  
Further work on the modules that comprise the many expert systems in ACexpert  
will take place. The full system will begin to take shape, and the  
demonstration AAS unit will become available for real-time testing.

BUDGET AND RESOURCES:	Year: (* current)	1	2*	3	TOTAL
	Cost: (\$000's):	74.4	26.4	50.4	151.2
	Work Years: 3				

Budget Source: RAC

KEYWORDS: expert system, AA, metal analysis

OUTPUT (papers, presentations, reports):

PUBLICATIONS:

1. Browett, W.R.; Cox, T.A.; Stillman, M.J. (1989) Design of an expert system  
for automated metal analysis by atomic absorption spectrometry. In ACS  
Symposium Series, 408, 210-235.
2. Gasyna Z.; Browett, W.; Nyokong, T.; Kitchenham, R.; Stillman, M.J. (1989)  
Microcomputer-aided Chemistry. 5. Interactive computing for instrument  
control and data analysis in photochemical studies. Chemometrics and  
Intelligent Laboratory System, 5, 233-246.
3. Browett, W.R.; Stillman, M.J. (1989) Use of expert system shells in the  
design of ACexpert for automated atomic absorption spectrometry. Progress  
in Analytical Spectroscopy, 12, 73-110.

OUTPUT (papers, presentations, reports):Cont'd:  
PUBLICATIONS:

4. Stillman, M.J.; Moussa, M. and Gasyna, Z. (1989) "Development of ACexpert. 3. Rules in ACdiagnosis and ALCmethods", Proceedings of the Technology Transfer Conference, Toronto, 20-21st November 1989, published by the Ontario Ministry of the Environment.
5. Stillman, M.J. Cox, T.A.; and Browett, T.A. (1988) "Development of ACexpert. 2. Implementation of an expert system for automated metal analysis by AAS", Proceedings of the Technology Transfer Conference, Toronto, 29th-30th November 1988, published by the Ontario Ministry of the Environment.
6. "Development of ACexpert. 1. Design of an Expert System for Automated Metal Analysis by Atomic Absorption Spectroscopy", William R. Browett, Timothy A. Cox and Martin J. Stillman, Department of Chemistry, University of Western Ontario, London, Ontario N6A 5B7.
7. "Expert system shells in analytical chemistry. The design of ACexpert: Automation of metal ion determination using AAS", submitted to Progress in Analytical Chemistry.

CONFERENCE PAPERS:

1. Gasyna, Z.; Stillman, M.J. "Design of an expert system for automated metal analysis by atomic absorption spectrometry", Pacificchem, December 17th-22nd, 1989.
2. Stillman, M.J.; Moussa, M.; Gasyna, Z. "Development of ACexpert 3. Encoding rules for ACdiagnosis", Technology Transfer Conf. Ontario Min. Environment, Toronto, 20th-21st November, 1989.
3. Gasyna, Z.; Stillman, M.J. "Use of expert system techniques in the analysis of environmental samples", 10th Annual meeting, Soc. Env. Tox. and Chemistry, Toronto, October, 28th - November, 2nd, 1989.
4. Stillman, M.J.; Cox, T.D.A.; Browett, W.R. "Development of ACexpert. 2. Implentation of an expert system for automated metal analysis by atomic absorption spectroscopy." 9th Technology Transfer Conference (MOE), Toronto, 29th-30th November 1988.
5. Browett, W.R.; Cox, T.D.A.; Stillman, M.J. "ACanalyst: a real-time advisor for atomic absorption spectrometer control and analysis.", ACS National Conference, Los Angeles, USA, 25th-30th September 1988.
6. Cox, T.D.A.; Browett, W.R.; Stillman, M.J. "Development of robotic sample handing and introduction into an atomic absorption spectrometer", The 3rd Chemical Congress of North America, Toronto, June, 1988.
7. Browett, W.R. Cox, T.D.A.; Stillman M.J. "Development of an expert system for quality control monitoring of metal analyses using atomic absorption spectroscopy", The 3rd Chemical Congress of North America, Toronto, June, 1988.

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EXTERNAL PARTICIPATION (ministries, governments, agencies):

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COMMENTS: This project is a continuation of that started under project #326PL. Currently in progress.

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

Contract  
Grant X

Solicited  
Unsolicited X

PROJECT TITLE: Development of Multivariate Analysis  
Procedures for Ontario Air Quality Data

PROJECT NO: 433G  
START DATE: 05/89

SHORT TITLE: Multivariate Analysis of Air Quality

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. P.K. Hopke  
Clarkson University

LIAISON OFFICER (name, location, telephone no.): Dr. N. Reid  
Air Resources Branch  
326-1691

OBJECTIVE(S): To complete the development of three-mode factor analysis to provide simultaneous temporal-spatial analysis of multisite air quality data. To compare the use of the Potential Source Contribution Function (PSCF) for source identification of the acidic components of collected airborne particle samples with the results previously obtained for acidic precipitation. To examine the use of unsupervised pattern recognition methods as well as several other eigenvector methods to identify the interrelationships between the particle or precipitation composition variables and their relationship to the meteorological regimes that existed when the samples were taken.

PROJECT DESCRIPTION: The Air Resources Branch has a number of on-going air quality monitoring programs that produce large multivariate data sets. The availability of state-of-the-art multivariate statistical analysis methods that will permit the maximum amount of useful information to be extracted from these data can aid the development and implementation of air quality management plans to maintain or improve the air quality in Ontario. This project combines the development of new methods that will provide improved analysis of the data and the testing of existing methods as to their utility to providing useful information from the air quality data that are available.

BUDGET AND RESOURCES:	Year: (* current)	1	2*	3	TOTAL
	Cost: (\$000's):	18.8	19.8	20.6	59.2
	Work Years: 3				

Budget Source: RAC (in U.S. funds)

KEYWORDS: multivariate analysis, air quality data, Ontario, analysis procedure, acidic precipitation

OUTPUT (papers, presentations, reports): Papers presented at the Technology Transfer Conference 1988, 1989.

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: In progress, second year.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).



RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

PROJECT TITLE: Investigations Into the Analysis of Hydride-Forming Elements	PROJECT NO: 434G START DATE: 5/89
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SHORT TITLE: Hydride Analysis

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. I. Brindle  
Brock University

LIAISON OFFICER (name, location, telephone no.): Dr. J.C. Hipfner  
Laboratory Services Branch  
235-5856

OBJECTIVE(S): 1) The simultaneous analysis of the maximum number of hydride-forming elements with the lowest possible detection limit (of the order of 10-100 ppt). 2) Application of the above method to air filters. 3) Transferrability of the hydride method to a continuous hydride generator for potential application as an interface to ICP-AES and ICP-MS. 4) Development of a preconcentration method for hydride-forming elements for potential application to surface waters and rain.

PROJECT DESCRIPTION: The development of methods for the analysis of hydride-forming elements will be useful in acid rain studies and in studies related to toxic hydride-forming elements. Methods for the analysis of germanium and tin, developed during the first year of this study, by hydride generation will be applied to the analysis of these elements in air filters. Extension of the hydride method to the analysis of arsenic and antimony will continue. The hydride-generation/interference reduction method for the analysis of selenium and tellurium will be investigated and attempts will be made to apply this to air filters. Optimum conditions will be determined for the simultaneous analysis of hydride-forming elements. Continuous hydride generation will be investigated with a view to interfacing the hydride system to either ICP-AES or ICP-MS systems. Methods for preconcentration of hydride-forming elements from surface water or rain will be developed.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3*	TOTAL
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Cost: (\$000's):	46.8	44.8	135.9
Work Years: 3			

Budget Source: RAC

KEYWORDS: analysis, hydride-forming elements, interferences, suppression

OUTPUT (papers, presentations, reports):

Ian D. Brindle and Xiao-chun Le, "D.C. Plasma Atomic Emission Spectrometry in Geochemical Applications" (Review), Geoscience Canada, Accepted for publication, June 19, 1989.

Ian D. Brindle and Xiao-chun Le, "Reduction of Interferences in the Determination of Germanium by Generation of Hydride and Atomic Emission Spectrometry", Analytica Chimica Acta, accepted for publication, June 30, 1989.

Ian D. Brindle and Xiao-chun Le, "Application of Signal Enhancement by Easily Ionized Elements in Hydride Generation Direct Current Plasma Atomic Emission Spectrometric Determination of Arsenic, Antimony, Germanium, Tin, and Lead", Analytical Chemistry, 1989, 61,1175-1178.

OUTPUT (papers, presentations, reports): Cont'd.

Ian D. Brindle, Xiao-chun Le and Xing-fang Li, "Determination of Traces of Germanium by Hydride Generation - D.C. Plasma Atomic Emission Spectrometry. Interference Reduction by L-Cystine and L-Cysteine," Journal of Analytical Atomic Spectrometry, 1989, Journal of Analytical Atomic Spectrometry, 4, 227-232.

Ian D. Brindle and Xiao-chun Le, "Determination of Traces of Tin by Hydride Generation - D.C. Plasma Atomic Emission Spectrometry. Interference Reduction by L-Cystine," 1988, The Analyst (London), 113, 1377-1381.

Charles Boampong, Ian D. Brindle, Xiao-chun Le, Lav Pidwerbesky, and Claudio Ceccarelli-Ponzoni, "Interference Reduction by L-Cystine in the Determination of Arsenic by Hydride Generation," 1988, Analytical Chemistry, 60, 1185-1188.

Ian D. Brindle and Hengqu Chen and Xiao-chun Le, "prereduction of Arsenic(V), Enhancement of the Signal, and Reduction of Interference by L-Cysteine in the Determination of Arsenic by Hydride Generation", Journal of Analytical Atomic Spectrometry, accepted for publication March 1990.

Ian D. Brindle and Xiao-chun Le, "A New Sample Introduction System for Direct Current Plasma Atomic Emission Spectrometry (DCP-AES)", Journal of Analytical Atomic Spectrometry, accepted for publication February 1990.

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EXTERNAL PARTICIPATION (ministries, governments, agencies):

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COMMENTS: Year 1 of project funded in 87/88 for \$44,300 under Proj. #360G. In progress.

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).



RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

Contract  
Grant X

Solicited  
Unsolicited X

PROJECT TITLE: Modelling Municipal Water Systems for  
Demand Management

PROJECT NO: 437G  
START DATE: 09/89

SHORT TITLE: Water Systems Management

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. J.E. Robinson  
University of Waterloo

LIAISON OFFICER (name, location, telephone no.): J. Donnan  
Policy & Planning Branch  
323-4579

OBJECTIVE(S): It is proposed to develop a computer model that will enable policies for water demand management to be evaluated. Such policies will include economic incentive policy instruments such as water rate structure, water rate level and wastewater surcharges. The model will be designed so that comparisons can be made between the cost effectiveness of demand management approaches to the supply management approach. The model will be useful for forecasting water prices, timing of supply system expansions, etc.

PROJECT DESCRIPTION: The Master Water Supply Study completed for the Regional Municipality of Waterloo in 1987 contains recommendations for structural water supply development which will result in substantial increases of the real cost of water. The study presumed that there will be structural changes in wastewater treatment to enable the full development of the water supply from river withdrawals. The study did not consider the implications to higher price on demand for water or the implications for expansion of wastewater treatment plants. It is proposed to develop a computer model integrating water supply and wastewater treatment for the use of municipal water managers which will be useful in evaluating such studies and for evaluating strategies for demand management, which may prove useful in delaying or avoiding expensive structural developments.

BUDGET AND RESOURCES:	Year: (* current)	1	2*	3	TOTAL
	Cost: (\$000's):	34.0	18.6		52.6
	Work Years: 2				

Budget Source: RAC

KEYWORDS: municipal water systems, demand management, water supply, water conservation, cost-effectiveness

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: In progress, second year.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X	Contract X	Solicited
INTERNAL	Grant	Unsolicited X

PROJECT TITLE: Quantifying Infiltration Through  
Municipal Solid Waste Landfill Covers

PROJECT NO: 440C  
START DATE: 7/89

SHORT TITLE: Landfill Cover Infiltration

PRINCIPAL INVESTIGATOR AND AFFILIATION: K.J.G. McKague  
Ecologistics Limited

LIAISON OFFICER (name, location, telephone no.): C.A. Bostock  
Waste Management Branch  
323-5218

OBJECTIVE(S): 1) Install lysimeters in landfill covers possessing distinct differences in the cover's soil texture. 2) Accumulate data on landfill cover infiltration for the soil textures considered through rainfall simulation and continued monitoring of the installations. 3) Modify an existing U.S. - Environmental Protection Agency landfill cover water budget/leachate generation model to facilitate its use under Ontario conditions. 4) Evaluate the usefulness of the modified model for predicting cover infiltration rates.

PROJECT DESCRIPTION: A fifteen (15) month study will further investigate infiltration through landfill covers. On the assumption that existing prototypes are producing satisfactory results and only minor modifications are required, additional lysimeters will be installed on landfill caps having extremes in soil textural characteristics. To increase the infiltration database, rainfall simulation will be carried out. An existing model will be modified and tested to determine its usefulness in predicting infiltration rates.

BUDGET AND RESOURCES:	Year: (* current)	1	2*	3	TOTAL
	Cost: (\$000's):	97.9	24.0		121.9
	Work Years: 2				

Budget Source: RAC

KEYWORDS: Solid waste, landfill covers, infiltration

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: In progress. Two sets of three lysimeters have been installed, one in the gravelly loam cover of the Guelph Landfill and one in the sandy cover of the Barrie Landfill. Remaining work includes infiltration experiments and monitoring, simulation modelling and reporting.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

Contract X  
Grant

Solicited  
Unsolicited X

PROJECT TITLE: In Situ Biodegradation of Chlorinated  
Solvents as a Remedial Technology for Contaminated  
Groundwater

PROJECT NO: 441C  
START DATE: 7/89

SHORT TITLE: In Situ Biodegradation of Solvents

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. D. Major  
Beak Consultants Ltd.

LIAISON OFFICER (name, location, telephone no.): A. Lye  
Water Resources Branch  
323-4893

OBJECTIVE(S):

To determine factors and processes governing in situ transformation and degradation of tetrachloroethylene in the groundwater at a chemical transfer facility, thereby furthering understanding of microbial processes at spill sites.

PROJECT DESCRIPTION:

This study will involve conducting field and laboratory experiments to determine what factors and processes are governing the in situ transformation and degradation of tetrachloroethylene (PCE) in the groundwater at a chemical transfer facility. Available data suggest that PCE is being degraded biologically by the indigenous micro-organisms to less chlorinated intermediates which are in turn mineralized to CO<sub>2</sub>.

BUDGET AND RESOURCES:	Year: (* current)	1	2*	3	TOTAL
	Cost: (\$000's):	40.0	40.0		80.0
	Work Years: 2				

Budget Source: RAC, U.S. and Industry, (cost-sharing RAC provided \$80,000)

KEYWORDS: Chlorinated solvents, contaminated groundwater

OUTPUT (papers, presentations, reports):

Presentation to supporting agencies and educational institutional institutors early in 1990.

EXTERNAL PARTICIPATION (ministries, governments, agencies): Environment Canada, General Electric, AT&T, C-1-6, Celenese.

COMMENTS: In progress.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

Contract  
Grant X

Solicited  
Unsolicited X

PROJECT TITLE: Ecology and Control of the Biofouler, PROJECT NO: 443G  
Dreissena polymorpha, (Bivalvia: Dreissenidae), New to START DATE: 05/89  
the Great Lakes

SHORT TITLE: Ecology and Control of Zebra Mussels

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. G.L. Mackie  
University of Guelph

LIAISON OFFICER (name, location, telephone no.): Mr. P. Kauss  
Water Resources Branch  
323-4952

OBJECTIVE(S): (1) To determine life history characteristics of the Lake St. Clair population of Dreissena polymorpha. (2) To determine the age and growth rate of individuals and of the population in Lake St. Clair and the extent of its distribution and growth rates in the Great Lakes. (3) To determine the potential impact of the zebra mussel on native species of unionid mussels in Lake St. Clair and some of its major tributaries.

PROJECT DESCRIPTION: A major biofouler and nuisance organism, Dreissena polymorpha (Bivalvia: Dreissenidae) was discovered in the Great Lakes this past fall. It is new to North America and nothing is known about its population dynamics and impact on other organisms, especially Bivalvia, in the Great Lakes, or indeed in any North American surface waters. Studies are described to determine the life history characteristics of D. polymorpha, commonly called the zebra mussel, in Lake St. Clair, its present growth rate and population age structure and its distribution in the Great Lakes and its potential impact on native species of unionid mussels endemic to Lake St. Clair and its major tributaries. The information on life history and distribution will be used to recommend to municipalities and industries measures to avoid infestations in domestic and industrial intake pipelines. The study is a pre-requisite to a proposal submitted to the Wildlife Toxicology Fund for controlling infestations of the zebra mussel in the Great Lakes.

BUDGET AND RESOURCES:	Year: (* current)	1	2*	3	TOTAL
	Cost: (\$000's):	31.5	29.9	25.1	86.5
	Work Years: 3				

Budget Source: RAC

KEYWORDS: Dreissena, polymorpha, biofouler

OUTPUT (papers, presentations, reports): Resche, P. "Zebra Mussels" Seasons, (Summer 1990), Federation of Ontario Naturalists.

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

PROJECT TITLE: Groundwater Impact From Large Septic Systems for Sewage Disposal in Ontario	PROJECT NO: 444G
	START DATE: 05/89

SHORT TITLE: Large Septic Systems

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. J.A. Cherry  
University of Waterloo

LIAISON OFFICER (name, location, telephone no.): W. Blackport  
West Central Region  
521-7703

OBJECTIVE(S): To better understand contaminant attenuation processes in large septic systems and develop a method to predict the extent of aquifer contamination new large septic systems.

PROJECT DESCRIPTION: About 20% of households in Ontario use septic systems, thus such systems represent the largest volumetric source of groundwater contamination, yet the magnitude of their impact is not known in Ontario, or elsewhere where septic system usage is also high. Previous studies by us during the past two years have shown that a single domestic septic system can produce an extremely large zone of contamination for non-reactive contaminants such as Na<sup>+</sup> and NO<sub>3</sub><sup>-</sup>, but that biodegradable contaminants such as organics may be largely attenuated in the unsaturated zone above the water table below the tile field. Large volume septic systems however, may produce chemically different contaminant plumes due to higher dose rates resulting in reduced effluent residence time in the unsaturated zone. This study will: 1) investigate groundwater quality around two large septic systems in Ontario, 2) evaluate by field studies the effectiveness of alternative designs and/or effluent loading rates for minimizing groundwater contamination, 3) use mathematical models to evaluate on a more generic basis the implications with respect to groundwater protection of alternative septic system designs for achieving more favourable effluent loading rates, and therefore better effluent attenuation.

BUDGET AND RESOURCES:	Year: (* current)	1	2*	3	TOTAL
	Cost: (\$000's):	65.0	65.0	65.0	195.0
	Work Years: 3				

Budget Source: RAC

KEYWORDS: groundwater impact, septic system effluents, contamination sewage disposal

OUTPUT (papers, presentations, reports): Field Investigations of Septic Systems III, Long Point, Cambridge, Muskoka & Killarney Site 1989 (Feb. 1990).

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

Contract X  
Grant

Solicited  
Unsolicited X

PROJECT TITLE: Regional Low Flow Analysis for the  
Central and Southeastern Regions of Ontario

PROJECT NO: 445C  
START DATE: 05/89

SHORT TITLE: Regionalization/Low Flow Characteristics

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. H.S. Belore  
Cumming-Cockburn Limited

LIAISON OFFICER (name, location, telephone no.): Dr. L. Logan  
Water Resources Branch  
323-4989

OBJECTIVE(S): (1) To test available methodologies for predicting low flows in the Central and Southeastern regions. To identify suitable techniques for application and required research/refinements. (2) Develop an appropriate data base including additional parameters such as evaporation, groundwater fluctuations (well records). (3) Refine multivariate analysis techniques for predicting low flows. (4) Research to develop alternative computerbased graphical low flow regional techniques.

PROJECT DESCRIPTION: Many industrial and municipal dischargers are limited to specific concentrations of effluent based upon the extreme value low flow with various recurrence intervals for the receiving waters (needed for MISA program implementation). These extreme values are easily determined from historic data for gauged streams. However, ungauged streams are more commonly the receiving water and presently few estimation techniques are available. Therefore, this study will test available techniques from a previous study for the Southwestern/West Central regions and apply them to the Central and Southeastern regions. Then those preliminary techniques will be enhanced and new techniques will be investigated developed and tested to provide methods for estimating extreme value low flows for ungauged sites in Central and Southwestern Ontario.

BUDGET AND RESOURCES:	Year: (* current)	1*	2	3	TOTAL
	Cost: (\$000's):	52.5			52.5
	Work Years: 1				

Budget Source: RAC

KEYWORDS: groundwater, Central and Southeastern Ontario

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: In progress.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).



RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

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PROJECT TITLE: Standardized Rearing Materials and Procedures for <u>Hexagenia</u> , a Benthic Bioassay Organism	PROJECT NO: 450G START DATE: 05/89
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SHORT TITLE: Hexagenia Rearing Materials and Procedures

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PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. Jan J.H. Ciborowski  
University of Windsor

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LIAISON OFFICER (name, location, telephone no.): D. Bedard  
Water Resources Branch  
323-4930

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OBJECTIVE(S): Collection and cold-storage maintenance of genetically homogeneous Hexagenia egg stocks for distribution to laboratories on request. Synthesis of a standard aquatic sediment and diet from commercially available materials suitable for quickly rearing contaminant-free benthic aquatic invertebrates. Comparison of larval Hexagnia growth on natural (MOE bioassay control site) sediment with synthetic sediment. Assessment of factors contributing to variation in Hexagenia growth and body size. Assessment of influence of sediment-bound organichlorine contaminants on substrate preference, survival, development and bioaccumulation of Hexagenia larvae. Expansion of sediment/diet protocols to scales suitable for mass-culture of rapidly-growing contaminant-free bioassay test organisms.

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PROJECT DESCRIPTION: Realization of the importance of sediment-bound contaminants to transfer and retention papameters in aquatic systems has stimulated development of diverse research techniques. However, these techniques (toxicokinetics studies, bioassay procedures, field biomonitoring) suffer from lack of standardization in control sediments and availability of test animals. We will develop a synthetic sediment suitable for rapid growth of Hexagenia, a widely-used bioassay and biomonitor organism, for use in sediment-bioassay trials and ecotoxicological studies. We will also develop rapid culture techniques for rearing contaminat-free organisms and determine methods of minimizing interindividual variations in development; factors that reduce the power to detect effects in bioassay and toxicokinetic studies. Additionally, we will maintain egg stocks from a single population and make material available to other laboratories to assist in maximizing comparability of ecotoxicological research.

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BUDGET AND RESOURCES:	Year: (* current)	1	2*	3	TOTAL
	Cost: (\$000's):	22.8	25.5		48.3
	Work Years: 2				

Budget Source: RAC

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KEYWORDS: Hexagenia, benthic bioassay organisms

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OUTPUT (papers, presentations, reports):

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EXTERNAL PARTICIPATION (ministries, governments, agencies):

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COMMENTS: In progress.

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

Contract X  
Grant

Solicited  
Unsolicited X

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PROJECT TITLE: Multispectral Remote Sensing Techniques for Past, Present and Future Mapping of Chlorophyll      PROJECT NO: 452C  
START DATE: 08/89

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SHORT TITLE: Chlorophyll Remote Sensing

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PRINCIPAL INVESTIGATOR AND AFFILIATION: Mr. Arunas R. Kalinauskas  
Moniteq Limited

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LIAISON OFFICER (name, location, telephone no.): Dr. N. Hutchinson  
Water Resources Branch  
(705) 766-2412

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OBJECTIVE(S): 1) Simulate landsat MSS and Landsat TM data using Programmable Multispectral Imager (PMI) data and correlate the simulated Landsat data with OME chlorophyll samples collected near simultaneously with the imagery. This correlation can then be used for historical, present and future derivations of chlorophyll concentrations from the Landsat series of satellites.

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PROJECT DESCRIPTION: Landsat TM and MSS data will be simulated from archived PMI data which was collected co-incident with OME chlorophyll and water quality sampling in the Lake of the Woods. MONITEQ will develop a methodology, to correlate the simulated Landsat imagery with the chlorophyll sampling for use in mapping past, present and future chlorophyll samples from Landsat imagery. A second methodology will be developed to create and test an optimized spectral bandset for remote chlorophyll mapping. Again the candidate bandsets for evaluation will be synthesized from the archived PMI data. The optimized chlorophyll mapping bandset will be available for use in state of the art remote sensors for airborne mapping of chlorophyll.

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BUDGET AND RESOURCES:	Year: (* current)	1	2*	3	TOTAL
	Cost: (\$000's):	41.9	7.2		41.9
	Work Years: 1				

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Budget Source: RAC

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KEYWORDS: multispectral remote sensing, chlorophyll, mapping, water quality

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OUTPUT (papers, presentations, reports):

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EXTERNAL PARTICIPATION (ministries, governments, agencies): OMNR - Lake of the Woods Fisheries Assessment Unit, Ontario Centre for Remote Sensing, Advice and transportation.

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COMMENTS: This is a research component of a WRB project to investigate factors responsible for increased frequency and intensity of algal blooms in Lake of the Woods, Ontario.

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).



RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

Contract  
Grant X

Solicited  
Unsolicited X

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PROJECT TITLE: New Methods for Rapid Sample Digestion      PROJECT NO: 453G  
START DATE: 08/89

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SHORT TITLE: Rapid Sample Digestion

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PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. Eric D. Salin  
McGill University

LIAISON OFFICER (name, location, telephone no.): D. Boomer  
Laboratory Services Branch  
235-5858

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OBJECTIVE(S):

The objective is to develop a system which will process batches of samples. The process involves microwave digestion of the samples while they are in a tube. The results should be a system which digests samples much faster and with minimal hazard.

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PROJECT DESCRIPTION:

The development of an automated flowing stream microwave digestion is proposed based on the grantee's preliminary work described at the 1988 MOE Technology Transfer Conference.

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BUDGET AND RESOURCES:	Year: (* current)	1	2*	3	TOTAL
	Cost: (\$000's):	20.0	20.0		40.0
	Work Years: 2				

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Budget Source: RAC

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KEYWORDS: microwave digestion

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OUTPUT (papers, presentations, reports): Progress Report June 1990.

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EXTERNAL PARTICIPATION (ministries, governments, agencies):

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COMMENTS: In progress.

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

Contract X  
Grant

Solicited X  
Unsolicited

PROJECT TITLE: Standard Reference Materials For Trace  
Organic Analysis of Aqueous Environmental Samples

PROJECT NO: 454C  
START DATE: 07/89

SHORT TITLE: Standard Reference Materials for Trace Organic Analysis

PRINCIPAL INVESTIGATOR AND AFFILIATION: Mr. J.A. Coburn  
Zenon Environmental Inc.

LIAISON OFFICER (name, location, telephone no.): Dr. D. Hall  
Laboratory Services Branch  
235-5910

OBJECTIVE(S): To conduct a comprehensive critical literature review of the preparation of standard aqueous solutions of highly hydrophobic materials, such as dioxins, organochlorine pesticides and polychlorinated biphenyls. Submit a copy of this review to the Drinking Water Organics Section.  
To prepare a number of generator columns for these hydrophobics, calibrate them and deliver these columns with appropriate certificates to the Drinking Water Organics Section.

PROJECT DESCRIPTION: A comprehensive and critical literature review of published solubility data for selected classes of environmentally hazardous hydrophobics of low solubilities. The various methods for the preparation of standard aqueous solutions of these materials, including stable isotope labelled compounds should be reviewed as well.  
To include computerized searching of Chemical Abstracts, data bases, NTIS reports, manual journal searches and personal contacts with other workers in related areas.

1) Dioxins, 2) PCB's, 3) Organochlorine Pesticides

BUDGET AND RESOURCES:	Year: (* current)	1	2*	3	TOTAL
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Cost: (\$000's):	28.0	16.0		44.0
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Work Years: 2

Budget Source: RAC

KEYWORDS: Aqueous environmental samples, standard reference materials, Trace Organic analysis, SRM, PCB, dioxins, Generator columns.

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: In progress.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

PROJECT TITLE: An Assessment of Landuse Impact on the Microclimate of the Fonthill Kame	PROJECT NO: 457G START DATE: 08/89
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SHORT TITLE: Microclimate Assessment of the Fonthill Kame

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. Tony B. Shaw, Brock University

LIAISON OFFICER (name, location, telephone no.): Dr. D. Yap, Air Resources Branch (235-5773)

OBJECTIVE(S): Two criteria are suggested for assessing any likely modification to the Fonthill Kame's microclimate: any topographic change, particularly slope changes, which will result in (a) a decrease of nocturnal minimum temperature by 1°C below the threshold values as specified for tender fruit crops and (b) a reduction in wind speed below 1 m/sec under radiation frost conditions (Shaw et al, 1988). Accordingly, the principal objective of this study is to provide a detailed assessment of the Kame's microclimate in terms of its spatial variations in temperature, noting in particular evidence of the depth and rate of cold-air drainage on a variety of slopes under radiation frost conditions. Apart from providing the necessary information on the microclimate variations on the Kame, which to date are poorly understood, this aspect of the study could identify specific areas of the Kame where the application of numerical modelling studies will have a reasonable chance of showing significant results.

PROJECT DESCRIPTION: The Fonthill Kame, located in the Town of Pelham, is the most important tender fruit area above the Niagara Escarpment. The combination of a favourable climate and well-drained sandy loam soils permits the successful cultivation of tender fruits along with other fruit crops. The steep slopes of the Kame, projecting above the surrounding flat plain, facilitate the drainage of cold air under radiation frost conditions. The microclimate of the Fonthill Kame is to a large extent related to its topography. It is argued by some that structural changes to the topography of the Kame will modify this microclimate. The chief concern is that cold-air drainage on which the production of tender fruits depends could be altered significantly on those slopes which may support aggregate extraction. A modified climate could impact adversely on tender fruit crops on the Kame itself with possible consequences for areas contiguous to the Kame. This study therefore, will attempt to assess the impact of aggregate extractive use on the microclimate of the Fonthill Kame.

BUDGET AND RESOURCES:	Year: (* current)	1*	2	3	TOTAL
	Cost: (\$000's):	16.5	14.0		30.5
	Work Years: 2				

Budget Source: RAC

KEYWORDS: modelling, microclimates, Fonthill Kame, Landuse Impact

OUTPUT (papers, presentations, reports): Interim report, June 1990; Interim report, December 1989.

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: In progress.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

Contract X  
Grant

Solicited  
Unsolicited X

PROJECT TITLE: Review of Established Regulatory Policies  
Using Genotoxicity Tests, Current Capability, and  
Recommendations For Future Development

PROJECT NO: 459C  
START DATE: 07/89

SHORT TITLE: Regulatory Policies, Genotoxicity Tests

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. E.R. Nestman  
CANTOX Inc.

LIAISON OFFICER (name, location, telephone no.): Dr. M. Salamone  
Water Resources Branch  
235-5790

OBJECTIVE(S): Review and assess the usage of mutagenicity and genotoxicity test procedures by various regulatory bodies, with specific emphasis on the existing mandate of MOE. To address: current use of genotoxicity testing by governmental and regulatory jurisdictions nationally and internationally; critical review of the applicability of such tests for environmental decision making; compilation of an Index of short-term genotoxicity tests for regulatory decision making; summary of existing MOE testing capabilities; recommendations for future developments and estimates of associated costs for maintaining and developing further testing capabilities in MOE programs; development of an implementation plan of genotoxicity testing in the area of environmental management.

PROJECT DESCRIPTION: Several areas of concern will be dealt with in this study, pertaining to the usage of genotoxicity testing in regulatory situations internationally, and also more specifically with respect to the MOE. The report will be organized into three broad segments: (i) current approaches (internationally and within the Ministry) to genotoxicity testing as a regulatory tool; (ii) identification and assessment of the potential tests available for use; and (iii) a critical review of structures discussed in (i) in light of information summarized in (ii), with recommendations and implementation procedures for future consideration.

BUDGET AND RESOURCES:	Year: (* current)	1*	2	3	TOTAL
	Cost: (\$000's):	48.0			48.0
	Work Years:	1			

Budget Source: Evenly shared between ARB, WRB, LSB & HCCB

KEYWORDS: regulatory policies, genotoxicity tests, current capability, future development

OUTPUT (papers, presentations, reports): Presentation at Mutagenesis Gathering, June 1, 1990.

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: In progress.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT  
GRANT X

SOLICITED  
UNSOLICITED X

PROJECT TITLE: Statistical Assessment of Multivariate  
Ordination Techniques For Zoobenthic Communities and Water  
Chemistry For Lakes From Central Ontario

PROJECT NO: 461G  
START DATE: 10/89

SHORT TITLE: Multivariate Ordination Techniques Assessment

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. H. Harvey  
University of Toronto

LIAISON OFFICER (name, location, telephone no.): K. Somers  
Water Resources Branch  
323-4948

OBJECTIVE(S): To assess multivariate ordination techniques for zoobenthic  
communities and use the techniques to test whether zoobenthic communities are  
associated with water quality variables.

PROJECT DESCRIPTION: Benthic Invertebrates and water chemistry will be sampled  
from 15 lakes in the Muskoka region to supplement an existing set of 20 lakes.  
Benthos and water chemistry as well as simulated data sets will be analyzed using  
several multivariate ordination techniques to develop guidelines for the  
assessment of interpretation of ecological and environmental gradients. The  
ordination techniques will be assessed on the basis of their ability to recover  
non-linear community and environmental data. The second component of our study  
will test the relationships between complex benthic community and environmental  
data using the appropriate permutation tests. We will test further using  
environmental data by incorporating additional techniques which heretofore have not  
been employed in environmental studies.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
	Cost: (000's):	11.0	3.6		14.6
	Work Years: 1.2				

Budget Source: RAC

KEYWORDS:

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the  
Ministry. Please indicate budget source by organization (e.g. RAC, OPAC,  
Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT  
GRANT X

SOLICITED  
UNSOLICITED X

PROJECT TITLE: The Relative Effect of Individual  
Environmental Factors on Indicator Bacterial  
Survival

PROJECT NO: 462G  
START DATE: 10/89

SHORT TITLE: Environmental Factors/Indicator Bacterial Survival

PRINCIPAL INVESTIGATOR AND AFFILIATION: E. Harris  
Lake Simcoe Region Conservation  
Authority

LIAISON OFFICER (name, location, telephone no.): M. Young  
Laboratory Services Branch  
235-5866

OBJECTIVE(S): To evaluate the effects of water quality variables on bacterial  
survival in a lab setting.

PROJECT DESCRIPTION: In vitro survival experiments will be conducted by  
suspending membrane diffusion chambers, containing cultures of fecal coliforms,  
E. coli and P. aeruginosa in aquara. Concentrations of chemical parameters such  
as chloride dissolved phosphates, nitrates, nitrites, ammonium and dissolved  
organic carbon will be adjusted individually and their effect on bacterial die-off  
assessed. The effect of preditation and competition will be determined by adding  
non sterile water containing bacteria and plankton to chambers of the test  
bacteria. The effect of these biological factors on sediment bacterial survival  
will be determined by inoculating diffusion chambers, containning sterile and non  
sterile bed sediments, with the test bacteria. A total of 76 in vitro bacterial  
survival experiments will be performed.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
Cost: (000's):		46.0			46.0
Work Years: 1					

Budget Source: RAC

KEYWORDS:

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the  
Ministry. Please indicate budget source by organization (e.g. RAC, OPAC,  
Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT  
GRANT X

SOLICITED  
UNSOLICITED X

PROJECT TITLE: CO2 Production and Carbon Cycling  
in Precambrian Shield Watersheds

PROJECT NO: 465G  
START DATE: 10/89

SHORT TITLE: CO2 Production/Carbon Cycling

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. Sherry Schiff  
University of Waterloo

LIAISON OFFICER (name, location, telephone no.): P. Dillon  
Water Resources Branch  
(705) 766-2418

OBJECTIVE(S): To examine CO2 production in forested watersheds and quantify its importance to the production of acid neutralizing capacity. To examine CO2 fate in lakes by constructing mass balances for 2 lakes.

PROJECT DESCRIPTION: Production of CO2 and carbon cycling in forested watersheds is important in the quantification of the natural and anthropogenic sources and sinks of carbon with regard to the global carbon budget and the generation of alkalinity to neutralize the effects of acidic precipitation. The proposed research involves a detailed investigation of CO2 production and transport in a small forested subcatchment and the construction of carbon and carbon isotope mass balances for two watersheds of contrasting physical characteristics near Haliburton, Ontario. Carbon isotopes <sup>13</sup>C and <sup>14</sup>C will be used extensively to gain information unavailable from standard chemical measurements on process involved in and rates of carbon cycling, residence times in the various carbon pools and the contributing sources of CO2 to the lake carbon budget.

BUDGET AND RESOURCES:	Year: (* current)	1	2 *	3	TOTAL
	Cost: (000's):	33.6	32.6		66.2
	Work Years: 2				

Budget Source: RAC

KEYWORDS:

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)



RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT X  
GRANT

SOLICITED  
UNSOLICITED X

PROJECT TITLE: Determination of Hydrogeological and  
Contamination Transport Properties of Fractured,  
Weathered Leda Clay in Eastern Ontario

PROJECT NO: 466C  
START DATE: 10/89

SHORT TITLE: Hydrogeological and Contamination Transport Properties/Leda Clay

PRINCIPAL INVESTIGATOR AND AFFILIATION: Andre Y. D'Astous  
Fondex Limited

LIAISON OFFICER (name, location, telephone no.): R.A. Dunn  
Southeastern Region  
(613) 521-3450

OBJECTIVE(S): To assess the methods to determine the depth of hydraulically active, fractured Leda clay; to define maximum depths of fractures in clays of different thickness and deposition modes; to determine the contaminant transport properties of Leda clay; to define the minimum thickness of clay necessary to protect the underlying aquifer.

PROJECT DESCRIPTION: This research program will comprise field testing and modelling of groundwater transport phenomena. Monitoring and field experiments relating to groundwater flow, contaminant migration and physical properties of fractured clay will be conducted at four different sites in Eastern Ontario. Mathematical models will be employed to simulate field experiments. This research should lead to a better understanding of groundwater flow and contaminant migration in fractured Leda clay, and to an evaluation of a new in-situ hydrogeologic testing techniques.

BUDGET AND RESOURCES:	Year: (* current)	1	2 *	3	TOTAL
	Cost: (000's):	60.8	18.3		79.1
	Work Years: 2				

Budget Source: RAC

KEYWORDS: waste management, landfill, clay deposits

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)



RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT  
GRANT X

SOLICITED  
UNSOLICITED X

PROJECT TITLE: Practical Application of Fecal Coliform (FC) to Streptococcus Facesium Subsp. Casseliflavus SC and Bifidobacterium to SC Ratio to Determine Human and Animal Sources of Pollution

PROJECT NO: 467G  
START DATE: 04/90

SHORT TITLE: Human and Animal Sources of Pollution

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. P.L. Seyfried  
University of Toronto

LIAISON OFFICER (name, location, telephone no.): M. Young  
Laboratory Services Branch  
235-5866

OBJECTIVE(S): Development of a simple and reliable field procedure for tracing and identifying human and/or animal fecal wastes inputs into natural water bodies or storm sewers. To develop a method of isolating and identifying S. faecium subsp. casseliflavus and test the applicability of new ratios in the field to distinguish human from animal sources of pollution. Examine fecal specimens to determine the levels and survival rates of this group of indicator organisms.

PROJECT DESCRIPTION: Previous studies on the characterization of fecal indicator organisms have indicated that SC may be an exclusive indicator of animal fecal pollution. Bifidocateria, on the other hand, are present in high levels in sanitary sewage and are recovered in ghigh densities from human feces. To date no ratios using SC and bifidobacteria have been formulated or tested. It is the objective of this project to test the use of a novel group of indicator rations in the field. Samples from street and farm runoff, storm sewers, and lakes and rivers impacted upon by sewage treatment plants will be collected and analyzed for bifidobacteria, FC, EC, and SC. Results of the field studies will confirm the applicability of these ratios for use in place of FC/FS to characterize human or animal sources of pollution. Additional studies on the most appropriate isolation media for SC as well as the source and the comparative survival of the aforementioned organisms in the environment will be conducted.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
Cost: (000's):		27.5			27.5
Work Years: 1					

Budget Source: RAC

KEYWORDS: indicator bacteria, human/animal fecal inputs, FC, SC, EC, bifidobacteria

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT  
GRANT X

SOLICITED  
UNSOLICITED X

PROJECT TITLE: Zooplankton Communities and Water  
Chemistry of Sudbury Area Lakes: Changes  
Related to pH Recovery

PROJECT NO: 468G  
START DATE: 04/90

SHORT TITLE: Zooplankton Communities/Water Chemistry of Sudbury Lakes

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. Gary Sprules  
University of Toronto

LIAISON OFFICER (name, location, telephone no.): W. Keller  
Northeastern Region  
(705) 675-4501

OBJECTIVE(S): To investigate changes in zooplankton communities in Sudbury area lakes that have occurred since the 1970's and relate changes to altered water chemistry.

PROJECT DESCRIPTION: Survey of zooplankton species composition and water chemistry in 92 Sudbury area lakes, for comparison with data collected in 1971-1973 by Sprules and Harvey. In these studies, pH was the major determinant of zooplankton community structure in the Sudbury area, and acidified lakes contained a community typified by fewer species and a less complex structure than lakes contained a community typified by fewer species and a less complex structure than lakes of circumneutral pH. Recent literature suggests that Sudbury area lakes have become less acid in response to reductions in atmospheric acid loadings. Study will determine whether the observed recovery in pH is reflected in recovery of plankton communities in lakes, and if so, investigate rates of plankton recolonization of community change.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
	Cost: (000's):	24.1			24.1
	Work Years: 1				

Budget Source: RAC

KEYWORDS: zooplankton, water chemistry, pH, Sudbury lakes

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT  
GRANT X

SOLICITED  
UNSOLICITED X

PROJECT TITLE: Abiotic Factors Involved in  
Predicting Trace Metal Levels in Freshwater  
Bivalves

PROJECT NO: 469G  
START DATE: 04/90

SHORT TITLE: Abiotic Factor/Freshwater Bivalves

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. A. Tessier  
University of Quebec

LIAISON OFFICER (name, location, telephone no.): P. Kauss  
Water Resources Branch  
323-4952

OBJECTIVE(S): To describe biological significance of metals in sediments. To  
identify factors controlling metal accumulation by clams to enable prediction of  
these levels.

PROJECT DESCRIPTION: Empirical approaches have proven disappointing predicting  
trace metal (M) concentrations in benthic organisms. A promising alternative is  
to identify the mechanisms underlying biological metal uptake and to use this  
knowledge to develop predictive models based on the geochemical and biological  
processes involved. Based on experimental observations, a mechanism is proposed  
that involves a control through adsorption reactions of the dissolved M  
concentrations in the solution to which the organisms are exposed. In situ  
measurements are proposed to verify this mechanism in the dorset area with  
Elliptio complanta.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
	Cost: (000's):	22.0			22.0
	Work Years: 1				

Budget Source: RAC

KEYWORDS: trace metal, freshwater bivalves

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the  
Ministry. Please indicate budget source by organization (e.g. RAC, OPAC,  
Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT X  
GRANT

SOLICITED  
UNSOLICITED X

PROJECT TITLE: Sequential Sampling, Amphipod  
Abundance, and Lake Acidification: Development  
of a Simple and Ubiquitous Biomonitoring Tool

PROJECT NO: 470C  
START DATE:

SHORT TITLE: Sequential Sampling/Lake Acidification

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. R.L. France  
W.D.N.R.G. Limnetics

LIAISON OFFICER (name, location, telephone no.): N. Yan  
Water Resources Branch  
(705) 766-2412

OBJECTIVE(S): To develop a simple and ubiquitous procedure of sequential sampling  
and data interpretation for cost-effective biomonitoring of the effects of lake  
acidification.

PROJECT DESCRIPTION: Extensive research on absence or occurrence, detailed life  
history, and toxicological experiments, suggest that the amphipod Hyaletella azteca  
has the potential to function as an effective biomonitor of anthropogenic lake  
acidification. To date, however, no such strategy has been implemented. Through  
the pragmatic development of a ubiquitous sequential sampling program applied to  
the existing data base, the present proposal provides the empirical realization  
of the theoretical relationship of amphipods to lake pH. Incorporation of these  
results as a metric in the comprehensive assessment of the biological integrity  
of acid sensitive waters will be developed. The temporal integration of transient  
changes in spring meltwater chemistry is an important rationale for developing  
such cost-effective biomonitoring procedures.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
	Cost: (000's):	5.2			5.2
	Work Years:				

Budget Source: RAC

KEYWORDS: lake acidification, sequential sampling

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the  
Ministry. Please indicate budget source by organization (e.g. RAC, OPAC,  
Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT  
GRANT X

SOLICITED  
UNSOLICITED X

PROJECT TITLE: Psychosocial Impacts in Populations  
Exposed to Solid Waste Facilities and the  
Hagersville Tire Fire

PROJECT NO: 473G  
START DATE: 02\90

SHORT TITLE: Solid Waste Facilities/Hagersville Tire Fire/Impacts

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. S. Martin Taylor  
McMaster University

LIAISON OFFICER (name, location, telephone no.): R. Clarke  
Environmental Assessment Branch  
440-3455

OBJECTIVE(S): To investigate the psychosocial impacts in populations exposed to  
3 solid wastes facilities. To assess links between awareness, experience, and  
exposure.

PROJECT DESCRIPTION: The main activities to be conducted are: the epidemiologic  
survey, the depth interviews and the focus group sessions. The textual analysis  
will be on-going throughout. The data reduction and analysis will be completed for  
the survey and will be begun for the focus group session and depth interviews. The  
main data collection activities will be the conduct of the discussion group  
sessions and the continuation of the textual analysis. Data reduction and  
analysis effort will be devoted to the depth interviews, discussion group, focus  
group and textual material.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
	Cost: (000's):	123.3	83.2		206.5
	Work Years: 3				

Budget Source: RAC

KEYWORDS: psychosocial impacts, waste management, Hagersville

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the  
Ministry. Please indicate budget source by organization (e.g. RAC, OPAC,  
Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT X  
GRANT

SOLICITED  
UNSOLICITED X

PROJECT TITLE: A Study of Peak Ozone Levels in the  
Toronto Area

PROJECT NO: 474C  
START DATE:

SHORT TITLE: Ozone Levels/Toronto

PRINCIPAL INVESTIGATOR AND AFFILIATION: Mr. Lou Shenfield  
The MEP Company

LIAISON OFFICER (name, location, telephone no.): Dr. D. Yap  
Air Resources Branch  
235-5773

OBJECTIVE(S): The study will determine the ozone concentrations in the Greater Toronto Area that are caused by sources outside the area confirming results of the long-range transport Acid Deposition and Oxidant Model. The regression equations produced by the study could be used by the Ministry to forecast peak ozone levels with a high degree of accuracy at Air Quality Index locations in the Toronto area. The relationship between the one hour and eight hour average ozone levels will determine whether Ontario's present one hour average of 80-ppb criterion can be used as a surrogate for an eight hour average, which has been recently recommended for the protection of health.

PROJECT DESCRIPTION: Ozone levels and meteorological conditions in the Toronto area will be studied to determine the influence of long-range transport (LRT) of ozone and its precursors from external sources. Regression equations will be developed relating the maximum ozone levels reached and meteorological parameters. Peak one hour average ozone concentrations could be predicted using the regression equations for locations in the Toronto Area. The relationship between one hour and eight hour average ozone levels will be determined.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
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Cost: (000's):		11.9			11.9
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Work Years:

Budget Source: RAC

KEYWORDS: ozone levels

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT X  
GRANT

SOLICITED  
UNSOLICITED X

PROJECT TITLE: The Development of a Long Range  
Transport Model with a Nested Fine Resolution Grid

PROJECT NO: 475C  
START DATE: 06/90

SHORT TITLE: Long Range Transport Model

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. M. Niewiadomski  
The MEP Company

LIAISON OFFICER (name, location, telephone no.): Dr. C. Fung  
Air Resources Branch  
235-5776

OBJECTIVE(S): To combine the mesoscale simulations of atmospheric processes in GESIMA with ADOM for a grid square in Southern Ontario, producing a fine resolution (5 km x 5 km) nested grid for this area. The resulting average air quality and deposition levels will be for the smaller squares. Validation will be carried out by the analysis of a pollution episode and comparing the model results for the fine grid area with measurements.

PROJECT DESCRIPTION: The Eulerian long-range transport Acid Deposition and Oxidant Model (ADOM), having a grid square resolution in the horizontal of 127 km x 127 km in size, will be modified to produce a nested fine resolution grid to as low as the size 5 km x 5 km, within the grid square including Metro Toronto. This is to be achieved by combining ADOM with a mesoscale model, GESIMA, which has this fine resolution. The resulting model will thus incorporate the ADOM input meteorology and emission inventory for Eastern North America with the fine resolution input and output of GESIMS for the grid square that includes Metro Toronto.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
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Cost: (000's):	75.8				75.8
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Work Years:

Budget Source: RAC

KEYWORDS: ADOM, oxidant

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)



RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT X  
GRANT

SOLICITED  
UNSOLICITED X

PROJECT TITLE: Phytotoxicity of Uranium

PROJECT NO: 476C  
START DATE: Late 90

SHORT TITLE:

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. S.C. Sheppard  
Whiteshell Nuclear Research  
Establishment

LIAISON OFFICER (name, location, telephone no.): J.J. Negusanti  
Northeastern Region  
(705) 975-4501

OBJECTIVE(S): To determine the concentration of U in soil that is toxic to plant growth, and to relate this toxicity to concentrations of U in plants and in soil extracts. To investigate how toxicity to U varies with differences in soil properties and among plant species. To document symptoms and associated consequences of high levels of U.

PROJECT DESCRIPTION: Elevated levels of uranium (U) exist in Ontario soils, notably in Port Hope, associated with former radium processing, and near Elliot Lake, associated with former and current mining operations. Uranium in these settings does not represent a radiological hazard (although its radioactive progeny may). However, U is chemically toxic to plants, with some reports suggesting a level very close to normal background. This proposal is to establish toxicity levels for plants, using several soil types and plant species relevant to urban contamination scenarios. If toxicity is confirmed at levels found in Ontario soils, then the data will be important for setting cleanup criteria for remedial action.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
	Cost: (000's):	29.7			29.7
	Work Years:				

Budget Source: RAC, Low-level Radioactive Waste Management Office

KEYWORDS: uranium, phytotoxicity

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)



RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT  
GRANT X

SOLICITED  
UNSOLICITED X

PROJECT TITLE: Nonaqueous Phase Liquid (NAPL)  
Removal From Soil and Rock

PROJECT NO: 477G  
START DATE: 05/90

SHORT TITLE:

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. Grahame J. Farquhar  
University of Waterloo

LIAISON OFFICER (name, location, telephone no.): G. Hughes  
Waste Management Branch  
323-5216

OBJECTIVE(S): To identify and quantify technologies which may be suitable for the removal of NAPLs from fractured rock. The intention is to screen various methods including the applications of heat, low hazard solvents, oxidants and reductants in laboratory scale experiments in sand and rock. An important secondary objective of the work is to design, instrument and use the test cells since such equipment and procedures do not presently exist.

PROJECT DESCRIPTION: The research will study flushing, heating and dissolution as methods to remove spilled nonaqueous phase liquids (NAPLs) from soil and fractured rock. Experiments will be conducted at laboratory scale in triaxial units and test cells capable of examining rock fractures up to 1m<sup>2</sup> in projected area. NAPLs to be studied will include at least Freon 113, TCE, PCE and transformer oil. Promising technologies will be identified in terms of recovery efficiency and environmental protection. Full scale field trials will be planned and designed.

BUDGET AND RESOURCES:	Year: (* current)	1	2 *	3	TOTAL
	Cost: (000's):	80.0	80.0		160.0
	Work Years: 2				

Budget Source: RAC

KEYWORDS: groundwater, spills, NAPL

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT  
GRANT X

SOLICITED  
UNSOLICITED X

PROJECT TITLE: Interpretation of Sugar Maple Ring  
Chronologies from Central and Southern Ontario  
Using a Mixed Linear Model

PROJECT NO: 478G  
START DATE: 04/90

SHORT TITLE: Sugar Maple Ring Chronologies/Mixed Linear Model

PRINCIPAL INVESTIGATOR AND AFFILIATION: O. Allen  
University of Guelph

LIAISON OFFICER (name, location, telephone no.): D. McLaughlin  
Air Resources Branch  
456-2504

OBJECTIVE(S): To develop a statistical model relating climate to growth rate of  
sugar maple in Southern and Central Ontario. Using the below model, assess whether  
atmospheric pollutants have been a factor in the reduction of the growth rate of  
sugar maple in Southern and Central Ontario.

PROJECT DESCRIPTION: The Ontario Ministry of the Environment has conducted a  
major survey in which sugar maple ring widths were measured from over 1000 trees  
from three regions (Southwestern Ontario, Central Ontario and the Sault Ste. Marie  
area) representing high, moderate and low levels of atmospheric pollution. The  
study will analyze these data with respect to causes of decline, combined with  
whatever auxiliary information is available on weather, harvesting and management  
systems and insect and disease infestations. The central question will be  
answered by a test of whether there is a year by region interaction, after  
adjusting for all other potential causes of the decline in tree growth for which  
we can obtain data.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
	Cost: (000's):	8.7			8.7
	Work Years: 1				

Budget Source: APIOS

KEYWORDS: sugar maple, mixed linear model

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the  
Ministry. Please indicate budget source by organization (e.g. RAC, OPAC,  
Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT X  
GRANT

SOLICITED  
UNSOLICITED X

PROJECT TITLE: Dense Gas Dispersion Modelling  
Including Obstacles and Topography

PROJECT NO: 479C  
START DATE: 06/90

SHORT TITLE: Dense Gas Dispersion Modelling

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. S.R. Ramsay  
Envirotech Research Limited

LIAISON OFFICER (name, location, telephone no.): H. Sahota  
Air Resources Branch  
235-5764

OBJECTIVE(S): An extensive review of existing theoretical, experimental and field data relevant to delving the effects of topography and obstacles on dense gas dispersion. Development of analytical and numerical models to describe the effects of topography and obstacles. An extensive comparison study of model results with existing laboratory and field trial data, and the predictions of other models. The development of an operational modelling capability for emergency management including topography and obstacles.

PROJECT DESCRIPTION: This proposal describes a study to develop dense gas dispersion modelling in the presence of buildings, obstacles and topography. The study will use the GASTAR model developed by Dr. R. Britter of Cambridge Environmental Research Consultants and Dr. S. Ramsay of EnviroTech Research Limited as the basis for further development. The current GASTAR model has limited capabilities in computing dense gas dispersion influenced by obstacles and topography however considerable additional work is required to develop a model suitable for operational emergency management. The work necessary to achieve this capability on an operational basis is described.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
	Cost: (000's):	24.0	17.6		41.6
	Work Years: 2				

Budget Source: RAC

KEYWORDS: emergency response, gas dispersion, modelling

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT  
GRANT X

SOLICITED  
UNSOLICITED X

PROJECT TITLE: Basic and Applied Studies with a  
Trace Gas Analyzer

PROJECT NO: 480G  
START DATE: 05/90

SHORT TITLE: Trace Gas Analyzer

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. R.E. March  
Trent University

LIAISON OFFICER (name, location, telephone no.): G. DeBrou  
Air Resources Branch  
326-1660

OBJECTIVE(S): To carry out a program of research of ion-molecule reactions relevant to normal modes of operation of the TAGA.

PROJECT DESCRIPTION: A collaborative University-Ministry of the Environment, Ontario (MOE) study of the use of a Trace atmospheric Gas Analyzer (TAGA) over a period of three years is proposed. The TAGA is to be supplied by the MOE and installed at Trent University, Peterborough. Under the joint supervision of three university Investigators, research on gaseous ion/molecule reactions will be carried out and combined with optimizing analytical protocols for the detection and measurement of compounds of interest to the MOE. Emphasis will be given to the development of new techniques for chemical ionization of compounds deleterious to the environment, to the investigation of processes of ion fragmentation and ion cluster formation, and to the study of processes for the removal of specific compounds or classes of compounds.

BUDGET AND RESOURCES:	Year: (* current)	1	2 *	3	TOTAL
	Cost: (000's):	52.6	49.6	50.9	153.1
	Work Years:				

Budget Source: RAC, Laboratory Services Branch

KEYWORDS: TAGA

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT X  
GRANT

SOLICITED  
UNSOLICITED X

PROJECT TITLE: Determination of Residential Wood  
Burning Impact in Ontario Communities

PROJECT NO: 481C  
START DATE: Late 90

SHORT TITLE: Woodburning/Impacts

PRINCIPAL INVESTIGATOR AND AFFILIATION: Ms. M.E. Yandle  
Concord Scientific Corporation

LIAISON OFFICER (name, location, telephone no.): R. Potvin  
Northeastern Region  
(705) 675-4501

OBJECTIVE(S): The extent of residential woodburning combustion (RWC) in Ontario will be documented including RWC practices, alternative practices and control options. The study of the air quality in RWC communities will be used to examine the impact of the emissions with respect to the environmental and health concerns.

PROJECT DESCRIPTION: In a recent review, RWC has been sited as a source of emissions impacting air quality. The potential for RWC to be a problem is significant in Ontario and presently largely undocumented. The proposal plans to address this problem in two parts. Part I will investigate the actual impact in Ontario's woodburning community through an ambient air monitoring program. This program will include criterion and non-criterion toxic organic constituents and the use of potassium as a tracer of RWC sources. Part II will involved the characterization of emissions from Canadian wood stoves with locally available wood fuels.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
Cost: (000's):		74.6	58.6		133.2
Work Years: 2					

Budget Source: RAC

KEYWORDS: air quality, woodsmoke

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT  
GRANT X

SOLICITED  
UNSOLICITED X

PROJECT TITLE: Analysis of Spatial and Temporal  
Distribution of Inhalable Air Particulates  
in Ontario

PROJECT NO: 482G  
START DATE: 05/90

SHORT TITLE: Air Particulates/Spatial and Temporal Distribution Analysis

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. R. Martin  
University of Western Ontario

LIAISON OFFICER (name, location, telephone no.): J.C. Hipfner  
Laboratory Services Branch  
235-5856

OBJECTIVE(S): To conduct a thorough study on PM10 in order to characterize the inhalable particulates (IP) less than 10 microns. To design an inhalable particulate database for the Ministry of the Environment and to analyze the data for use in the process of setting an inhalable particulate standard for Ontario.

PROJECT DESCRIPTION: Inhalable air particulates, less than ten microns in average diameter, will be collected and studies to establish; (a) their bulk elemental composition, (b) the elemental distribution within individual particles, (c) the chemical state and reactivity of individual particles and aggregates of particles, (d) their size distribution and physical characteristics, (e) the spatial and temporal distribution of particles across the Province. A wide range of techniques will be used. Following collection of samples at approximately ten sites in Ontario using commercially available PM10 samples the material will be examined using X-ray fluorescence (XRF), Scanning Electron Microscopy (SEM), Secondary Ion Mass Spectrometry (SIMS), X-ray Photoelectron Spectroscopy (XPS) Electron Microprobe (EM), Scanning Auger Spectroscopy (SAM), Transmission Electron Microscopy (TEM) and various Synchrotron methods as well as optical methods including simple optical microscopy. The resulting data will be used to design an inhalable particulate standard for Ontario.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
	Cost: (000's):	58.5	58.5		117.1
	Work Years: 2				

Budget Source: RAC

KEYWORDS: inhalable particulates, standards

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT  
GRANT X

SOLICITED  
UNSOLICITED X

PROJECT TITLE: The Significance of Metabolic Changes  
in Jack Pine Seedlings for Early Diagnosis  
of Fluoride Injury

PROJECT NO: 483G  
START DATE: 04/90

SHORT TITLE: Jack Pine Seedlings/Fluoride Injury

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. J.J. Zwiazek  
University of Alberta

LIAISON OFFICER: (name, location, telephone no.): D. McLaughlin  
Air Resources Branch  
456-2504

OBJECTIVE(S): Determine threshold fluoride levels which result in the accumulation of starch in the chloroplast and depletion of membrane lipids. Establish whether these metabolic symptoms of fluoride injury can be mimicked by water stress. Determine the suitability of both metabolic symptoms of fluoride injury in early detection of fluoride damage.

PROJECT DESCRIPTION: The proposed study will investigate the effects of gaseous hydrogen fluoride on starch accumulation and the composition of membrane lipids in jack pine seedlings. It will determine the suitability of these metabolic parameters for early diagnostic detection of fluoride injury. The metabolic changes will be compared with those in water stressed plants to ensure that the effects of water stress and fluoride can be separated.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
	Cost: (000's):	40.5	19.0		59.5
	Work Years: 2				

Budget Source: RAC

KEYWORDS: fluoride, Jack pine

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)



RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT  
GRANT X

SOLICITED  
UNSOLICITED X

PROJECT TITLE: Retention of Toxic Landfill  
Leachate Metals by Soil

PROJECT NO: 484G  
START DATE: 05/90

SHORT TITLE:

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. L.J. Evans  
University of Guelph

LIAISON OFFICER (name, location, telephone no.): A. Oda  
Waste Management Branch  
323-5129

OBJECTIVE(S): To determine the amount of toxic metals, in particular Zn, Hg and Cd, retained by soils with widely differing characteristics so that predictions can be made on the amount of leachate metals retained by Ontario soils as a function of pH, clay and organic matter contents and mineralogy. Results from these studies, should help predict the extent of metal retention by soils associated with landfill sites and estimate the rate of movement of toxic metals to surface and groundwaters.

PROJECT DESCRIPTION: Laboratory studies involving the use of adsorption isotherms, potentiometric titrations and leaching columns will be used to determine the absorption capacity of the soils. Surface complexation models, such as the Constant Capacitance Model, and transport flow equations will be used to calculate the rate of movement of the metals to surface and/or groundwater. The usefulness of these models will be tested in leached soils columns.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
	Cost: (000's):	39.0	39.0		78.0
	Work Years: 2				

Budget Source: RAC

KEYWORDS: landfill, leachate, soil, heavy metals

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT X  
GRANT

SOLICITED  
UNSOLICITED X

PROJECT TITLE: Ontario Hydrobiotite-Vermiculite  
as a Potential Landfill Liner and Adsorbent

PROJECT NO: 485C  
START DATE: 06/90

SHORT TITLE: Landfill Liner/Adsorbent

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. L.W. Curtis  
Curtis & Associates Inc.

LIAISON OFFICER (name, location, telephone no.): C.A. Bostock  
Waste Management Branch  
323-5218

OBJECTIVE(S): Determine the mineralogy, leaching and strength characteristics of specific controlled samples, and compare with known landfill-liners. Carry out detailed leaching and strength analysis. Refine any beneficiation technique required to improve stress characteristics of the mixed layer-mica vermiculite (MLMV). Gauge the economics of the product. In-situ dispersion, coring, and leaching tests of the Stanleyville pit as an analogue for a MLMV-lined pit.

PROJECT DESCRIPTION: An investigation of the potential use of southern Ontario vermiculite (Stanleyville Deposit) as a landfill-liner is produced. Vermiculite has an exceedingly high cation exchange capacity and may offer superior adsorbent characteristics relative to materials currently in use. Successful resolution of the project could have immediate beneficial impact on quality of landfill-liners in southern Ontario.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
	Cost: (000's):	47.7			47.7
	Work Years: 1				

Budget Source: RAC

KEYWORDS: landfill, liners, vermiculite

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT  
GRANT X

SOLICITED  
UNSOLICITED X

PROJECT TITLE: Verification Studies of a Body Burden  
Based Model for Predicting the Sublethal  
Toxicity of Fluctuating Contaminated Exposures to Fish

PROJECT NO: 486G  
START DATE: 04/90

SHORT TITLE: Contaminant Exposures/Fish

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. D. G. Dixon  
University of Waterloo

LIAISON OFFICER (name, location, telephone no.): C. Neville  
Water Resources Branch  
235-5799

OBJECTIVE(S): To demonstrate the utility of a body burden approached to aquatic toxicity problem solving and to integrate a body burden model in a diagnostic approach to ecosystem health assessment. To develop a scientific basis for developing water quality guidelines which are sensitive to pulse and fluctuating toxicant exposures.

PROJECT DESCRIPTION: The proposed research will develop burden-response relationships for sublethal and endpoints for PCP and another chlorinated organic compound in growth studies using fatheads minnows. The derived burden-response relationships will then be used in verification studies of a residue based, bioconcentration model to adequately estimate sublethal effects under non-equilibrium toxicant exposures. Modifying factors of kinetics (body size, lipid content) will be studied and threshold burdens of toxicity will be estimated for the subchronic exposure periods.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
	Cost: (000's):	28.4			28.4
	Work Years: 1				

Budget Source: RAC

KEYWORDS: toxicity, contaminants, exposures, fish

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT  
GRANT X

SOLICITED  
UNSOLICITED X

PROJECT TITLE: Removal of Chlorophenols from  
Wastewaters by the Photolysis of Hydrogen Peroxide  
Using Ultraviolet Light and Sun-Simulated Light

PROJECT NO: 487G  
START DATE: 04/90

SHORT TITLE: Chlorophenol Removal/Wastewaters

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. J.R. Bolton  
University of Western Ontario

LIAISON OFFICER (name, location, telephone no.): A. Edmonds  
Water Resources Branch  
323-2759

OBJECTIVE(S): To carry out an examination of the feasibility of the H2O2 photolysis process for the removal of organic pollutants from waste water streams. To establish optimum conditions for the H2O2 photolysis process and to determine the effectiveness of using natural sunlight as the photolysis source.

PROJECT DESCRIPTION: The possibility of removal of organic pollutants from waste waters by the uv photolysis of H2O2 is an attractive alternative technology because H2O2 is a readily available industrial chemical and has no known adverse effects on the environment. The proposed study aims to examine the sensitized photodegradation of chlorophenols as a test system.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
	Cost: (000's):	42.5			42.5
	Work Years: 1				

Budget Source: RAC

KEYWORDS: chlorophenol, wastewater

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT  
GRANT X

SOLICITED  
UNSOLICITED X

PROJECT TITLE: Impact of Livestock Manure and  
Fertilizer Application on Nitrate Contamination  
of Groundwater

PROJECT NO: 488G  
START DATE: 04/91

SHORT TITLE: Fertilizer/Groundwater Contamination

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. R.G. Kachanoski  
University of Guelph

LIAISON OFFICER (name, location, telephone no.): M. Blackie  
London Regional Office  
(519) 661-1710

OBJECTIVE(S): Determine the quantities of nitrate and dissolved organic carbon transported below the root zone from crops treated with different levels of N from manures and fertilizer in relation to crop response. Establish the influence of time of manure application on crop response and NO<sub>3</sub> N contribution of groundwater. Evaluate the potential for denitrification.

PROJECT DESCRIPTION: The focus of this study will be on the fate of nitrate and dissolved organic carbon originating from manures applied in the fall and spring. The movement of NO<sub>3</sub> and DOC to groundwater from manure treatments will be compared to NO<sub>3</sub> leaching from fertilizer nitrate treatments and to crop response. It is believed that manures may provide more DOC to promote the denitrification process below the root zone and thereby lessen the contribution of NO<sub>3</sub> to groundwater.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (000's):	74.2	69.2	69.2	212.6
	Work Years: 3				

Budget Source: RAC

KEYWORDS: fertilizer, groundwater, nitrate

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT  
GRANT X

SOLICITED  
UNSOLICITED X

PROJECT TITLE: Development of Reliable Treatment  
Systems for Milkhouse Wash Water

PROJECT NO: 489G  
START DATE: 04/90

SHORT TITLE: Reliable Treatment System/Water

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. P.H. Groenevelt  
University of Guelph

LIAISON OFFICER (name, location, telephone no.): K. Willson  
Water Resources Branch  
(705) 766-2418

OBJECTIVE(S): Determine the principal causes for the failure of the present disposal system. Identify possible remedial modifications which can be made to the treatment trench system or the washing procedure which will insure trouble-free operation of this system in poorly drained soils for at least 25 years. Failing the second objective, develop disposal alternatives which are both environmentally sound and acceptable to Ontario farmers.

PROJECT DESCRIPTION: At present a large proportion of installed Treatment Trench systems for the disposal of milkhouse wash water have failed leaving farmers no alternative but to dump untreated wash water into ditches of field tiles. The estimated 180 tonnes of phosphorus per years being discharge from milkhouses in southern Ontario represents a serious environmental problem. The proposed research will focus on the fundamental reasons for practices as well as investigating possible disposal alternatives.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
	Cost: (000's):	23.0	23.0		46.0
	Work Years: 2				

Budget Source: RAC

KEYWORDS: water

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT X  
GRANT

SOLICITED  
UNSOLICITED X

PROJECT TITLE: Evaluation of the Impact of Timber  
Management Practices on Lake Water Using  
Satellite Remote Sensing Data

PROJECT NO: 490C  
START DATE: 07/90

SHORT TITLE: Remote Sensing/Timber Management

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. H. George  
Geoscan Ltd.

LIAISON OFFICER (name, location, telephone no.): B. Neary  
Water Resources Branch  
(705) 766-2418

OBJECTIVE(S): To provide methodology for the routine operational surveillance of water quality impacts which are due to timber management practices and so alert the Water Resources Manager, in good time, of the need for detailed ground investigations.

PROJECT DESCRIPTION: Satellite remote sensing imagery of lakes will be digitally analyzed and used to map concentrations of inorganic suspended sediment which are related to logging activities within lake basins. The relationship between timber management practice and water quality will be evaluated.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
	Cost: (000's):	32.9			32.9
	Work Years:				

Budget Source: RAC

KEYWORDS: remote sensing, water quality

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)



RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT  
GRANT X

SOLICITED  
UNSOLICITED X

PROJECT TITLE: The Effectiveness of a Stormwater  
Management Pond in the Removal of Urban  
Contaminants from Stormwater

PROJECT NO: 491G  
START DATE: 05/90

SHORT TITLE: Urban Contaminant Removal/Stormwater Management

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. W.E. Watt  
Queen's University

LIAISON OFFICER (name, location, telephone no.): J. P'ng  
Water Resources Branch  
323-5218

OBJECTIVE(S): To evaluate the effects of on-line quantity/quality SWR control ponds with regard to discharge water quality through a case study in Kingston Township. Goals include: Gathering of 3 seasons of water quantity and quality data on an event basis for a SWR pond in Kingston Township. Calibration of a water quality/quantity model for the pond and creek system. Determination of a water and contaminant balance for the SWN pond.

PROJECT DESCRIPTION: This study will involve the study and monitoring of an on-line stormwater management control pond in Kingston Township with the object of characterizing the ability of the pond to remove water borne contaminants from the stormwater. It will consider how to enhance the contaminant removal function in future (on-line) stormwater control ponds.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
	Cost: (000's):	32.2	28.7	28.7	89.6
	Work Years: 3				

Budget Source: RAC

KEYWORDS: stormwater management

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT  
GRANT X

SOLICITED  
UNSOLICITED X

PROJECT TITLE: Causes of Pollution-Associated  
Neoplasms in Fish in Lake Ontario

PROJECT NO: 492G  
START DATE: 04/90

SHORT TITLE: Lake Ontario/Neoplasms

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. M. Hayes  
University of Guelph

LIAISON OFFICER (name, location, telephone no.): Ian R. Smith  
Water Resources Branch  
235-5788

OBJECTIVE(S): Determination of the cause of intercurrent liver diseases that affects white suckers and brown bullheads in the Great Lakes. Develop of risk assessment criteria for environmental PAHs according to various disease, age or nutritional states that might render certain individual fish & humans more susceptible to PAHs.

PROJECT DESCRIPTION: This project is aimed at determining the causative factors involved in pollution associated liver cancers in benthic fish (mainly white suckers), from industrially polluted sites in western Lake Ontario (Hamilton and Toronto). The study will establish the specific cause and role of the intercurrent hepatitis by determining how this disease interferes with glutathione S-transferase isoenzymes which are the most important detoxifying system for DNA-damaging metabolites of PAHs. These approaches toward the understanding of multifactorial carcinogenesis are essential to risk assessment of environmental PAHs because they will help to explain why these substances are sometimes carcinogenic but often are not. These studies will provide a mechanistic basis for deciding how health studies of wild fish can be reliably used to monitor the environmental improvements resulting from the MISA program.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
	Cost: (000's):	54.2	56.6		110.8
	Work Years: 2				

Budget Source: RAC

KEYWORDS: pollution, neoplasms

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT  
GRANT X

SOLICITED  
UNSOLICITED X

PROJECT TITLE: Geochemical Characterization and  
Size Fractionation of Metal/Particulate Discharges to  
the Don River

PROJECT NO: 493G  
START DATE: 04/90

SHORT TITLE: Metal/Particulate Discharges/Don River

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. A.P. Zimmerman  
University of Toronto

LIAISON OFFICER (name, location, telephone no.): G. Bowen  
Water Resources Branch  
323-4805

OBJECTIVE(S): To assess trace metal/particulate loads contributed by specific  
discharge sources to the Don River by geochemically characterizing the  
associations of Cd, Cu, Pb and Zn within 3 particle size classes of suspended  
particulates from discharge outfalls.

PROJECT DESCRIPTION: The project will assess trace metal/particulate loads  
contributed by specific discharge sources to the Don using geochemical phase  
and/or particle size as a means of "fingerprinting" discharge sources. By  
assessing metal loads contributed by specific discharge sources, the study will  
provide information that can be used to prioritize sources for abatement and  
evaluate the potential effectiveness of proposed remedial action plans.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
	Cost: (000's):	19.0			19.0
	Work Years: 1				

Budget Source: RAC

KEYWORDS: metal and particulate discharges, Don River

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the  
Ministry. Please indicate budget source by organization (e.g. RAC, OPAC,  
Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT  
GRANT X

SOLICITED  
UNSOLICITED X

PROJECT TITLE: Impact of Bleached Kraft Mill Effluent  
on Reproductive, Biochemical and  
Immunological Characteristics of White Sucker and Whitefish

PROJECT NO: 494G  
START DATE: 04/90

SHORT TITLE: White Sucker and Whitefish/Impacts of Effluent

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. G. Dixon  
University of Waterloo

LIAISON OFFICER (name, location, telephone no.): Ian R. Smith  
Water Resources Branch  
235-5788

OBJECTIVE(S): Increase knowledge of MFO systems in wild fish exposed to BKME. Determine the site of disruption of steroid metabolism and gonad maturation in BKME exposed fish. Evaluate the effect of BKME exposure on population characteristics and biochemistry of whitefish.

PROJECT DESCRIPTION: This study will examine the MFO response of white sucker to BKME in kidney, which may be a preferred test organ, as well as in liver. Results will aid in the evaluation of the impacts of pulp mills and knowledge gained will be useful in the development of protocols for evaluating the effects of a variety of contaminants on feral fish populations.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
	Cost: (000's):	44.1			44.1
	Work Years: 1				

Budget Source: RAC

KEYWORDS: Whitefish, White sucker

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT  
GRANT X

SOLICITED  
UNSOLICITED X

PROJECT TITLE: Flow of Manure Through Soil Macropores

PROJECT NO: 495G  
START DATE: 05/90

SHORT TITLE:

PRINCIPAL INVESTIGATOR AND AFFILIATION: Mr. R. Fleming  
Centralia College of Agriculture

LIAISON OFFICER (name, location, telephone no.): K. Willson  
Water Resources Branch  
323-4820

OBJECTIVE(S): Determine to what extent flow of manure through soil macropores occurs under typical conditions. Compare the macropore flow for the soil from 2 different tillage systems - no-till vs. conventional tillage.

PROJECT DESCRIPTION: Agricultural practices, and specifically manure spreading practices, have been blamed for some problems in the quality of surface waters. This study is aimed at determining to what extent soil macropores are important in the flow of liquid manure through soil. By conducting a laboratory experiment with several undisturbed soil cores taken from typical farm fields, the study will clear up how significant macropore flow is in the contamination of draining tile systems.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
	Cost: (000's):	53.1			53.1
	Work Years: 1				

Budget Source: RAC

KEYWORDS: manure, soil macropores

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT  
GRANT X

SOLICITED  
UNSOLICITED X

PROJECT TITLE: Characterization and Biotechnical Uses  
of the Extracellular Emulsifying Agent  
Produced by Pseudomonas aeruginosa

PROJECT NO: 496G  
START DATE: 04/90

SHORT TITLE: Extracellular Emulsifying Agent

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. H. Lee  
University of Guelph

LIAISON OFFICER (name, location, telephone no.): M. Young  
Laboratory Services Branch  
235-5866

OBJECTIVE(S): To purify the extracellular oil emulsifier produced by Pseudomonas aeruginosa UG2. To identify the culture conditions necessary for optimal emulsifier production by UG2. To UG2 or the partially purified extracellular emulsifier from UG2 into hydrocarbon-contaminated soil in order to assess the influence of in situ emulsification on subsequent biodegradation of the hydrocarbon.

PROJECT DESCRIPTION: Biological degradation in land farming sites is an attractive and ecologically acceptable means of disposing of wastes containing complex hydro-carbons. The proposed studies are intended to characterize bio-chemically a natural emulsifier produced by an environmental isolate of UG2. Positive research results arising from these studies may have considerable potential to enhance remediation in land farming or spill sites.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
	Cost: (000's):	47.3	47.3	47.3	141.9
	Work Years: 3				

Budget Source: RAC

KEYWORDS:

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT  
GRANT X

SOLICITED  
UNSOLICITED X

PROJECT TITLE: Automatable Total Cyanide Analysis

PROJECT NO: 497G

START DATE: 04/90

SHORT TITLE: Cyanide Analysis

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. D.W. Kirk  
University of Toronto

LIAISON OFFICER (name, location, telephone no.): J.C. Hipfner  
Laboratory Services Branch  
235-5856

OBJECTIVE(S): To develop an automated and reliable total cyanide analysis method. Demonstrate the selective UV decomposition can be used to avoid thiocyanate decomposition by provide quantitative complex canide recoveries. Determine the optimum conditions for decomposition of cyanide complexes. Determine the maximum concentrations of interfering ions that can be tolerated without affecting the cyanide analysis. Develop the method to the stage where a commerical prototype can be constructed.

PROJECT DESCRIPTION: This project will develop a method of total cyanide analysis in environmental waste water samples having complex metal cyanides and interfering species. The method requirements include high sensitivity, rapid determination and suitability for automation. The feature and automation is very important because the time now required to perform the standard manual distillation method severely restricts sample throughput rates and is operator intensive.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
	Cost: (000's):	29.5			29.5
	Work Years: 1				

Budget Source: RAC

KEYWORDS: cyanide analysis, automation

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)



RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT  
GRANT X

SOLICITED  
UNSOLICITED X

PROJECT TITLE: Development of an Automated Batch  
Hydride Generator for the Determination  
of Arsenic and Selenium

PROJECT NO: 498G  
START DATE: 04/90

SHORT TITLE: Automated Batch Hydride Generator/Arsenic & Selenium

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. Ian D. Brindle  
Brock University

LIAISON OFFICER (name, location, telephone no.): R.S. Sadana  
Laboratory Services Branch  
235-5861

OBJECTIVE(S): The assembly of a computer-controlled batch hydride generator system for the automated determination of elements such as arsenic and selenium. This system will take the sample from a carousel, deliver it to the hydride generator, add appropriate reagents, acquire the raw data, store, calculate concentrations and store in appropriate report format.

PROJECT DESCRIPTION: The investigator has shown, through published work, that the L-cysteine and L-cystine have been useful in overcoming interferences from transition elements in the determination of elements from groups IV and V. Modifications to a continuous hydride generator have proved to be very useful. This project will further modify the continuous hydride generator to operate in an intrinsically more sensitive mode to allow determination of these elements with greater sensitivity and lower detection limits.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
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Cost: (000's):		40.0			40.0
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Work Years: 1

Budget Source: RAC

KEYWORDS: hydride generator, arsenic, selenium

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT  
GRANT X

SOLICITED  
UNSOLICITED X

PROJECT TITLE: Supercritical Extraction Methods  
for Aqueous and Carbon Sorbent Samples

PROJECT NO: 499G  
START DATE: 04/90

SHORT TITLE: Extraction Methods/Carbon Samples

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. J.B. Pawliszyn  
University of Waterloo

LIAISON OFFICER (name, location, telephone no.): I. Ahmad  
Laboratory Services Branch  
235-6014

OBJECTIVE(S): To improve the speed and lower the cost of analysis of environmental samples by developing methods based on supercritical fluid extraction (SFE). To automate since the sample transfer can be implemented by flowing the fluids in the system. This will allow processing of large number of samples within reasonable time and cost. Separation of organic components from the fluid can be achieved simply by expanding the compressed gas. Supercritical fluid extractions are capable of fractionating complex, organic mixtures into groups and therefore extensive cleanup in many cases might be rendered necessary. SFE will be used to isolate 2 classes of toxins.

PROJECT DESCRIPTION: Analytical supercritical fluid extractions (SFE) significantly lower the cost, shorten the time and improve precision by about an order of magnitude for the analysis of harmful chemicals such as pesticides in solid and aqueous samples. The study focuses on methodology for rapid and representative determination of presence of these pollutants in groundwater and well materials. SFE will be used to extract polychlorinated dibenzoo-p-dioxins and dibenzofurans from the activated carbon sorbent used in a wastewater treatment plant.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
	Cost: (000's):	20.0	10.0		30.0
	Work Years: 2				

Budget Source: RAC

KEYWORDS: carbon, extraction methods

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT  
GRANT X

SOLICITED  
UNSOLICITED X

PROJECT TITLE: The Use of Environmental Isotope  
Surveys in Assessing Contamination Potential  
of Confined Aquifers

PROJECT NO: 500G  
START DATE: 04/90

SHORT TITLE: Isotope Surveys/Confined Aquifers

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. M. Sklash  
University of Windsor

LIAISON OFFICER (name, location, telephone no.): B. Novakovic  
London Regional Office  
(519) 661-2279

OBJECTIVE(S): To demonstrate the usefulness of regional environmental isotope  
surveys in assessing the contamination potential of regional confined aquifers.  
The freshwater aquifer in Essex County will be used as a case study.

PROJECT DESCRIPTION: A regional environmental isotope survey of the freshwater  
aquifer in Essex County indicates that anomalously very young groundwater exists  
beneath the thick clayey confining unit and remote from the most obvious recharge  
area. The proposed research program is designed to confirm the existence of the  
young groundwater, establish the spatial relationship between the buried esker and  
the young groundwater, and to determine the recharge mechanism for the young  
groundwater. This study has obvious relevancy for both point and non-point  
sources of groundwater contamination in both Essex County and in similar  
hydrogeological environments.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
	Cost: (000's):	26.3	24.6		50.9

Work Years: 2

Budget Source: RAC

KEYWORDS: confined aquifers

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the  
Ministry. Please indicate budget source by organization (e.g. RAC, OPAC,  
Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT  
GRANT X

SOLICITED  
UNSOLICITED X

PROJECT TITLE: Experimental and Theoretical Study of  
Guelph Pilot Scale Solid Waste Composter

PROJECT NO: 501G  
START DATE: 04/90

SHORT TITLE: Guelph Solid Waste Composter

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. L. Otten  
University of Guelph

LIAISON OFFICER (name, location, telephone no.): B. Killackey  
Waste Management Branch  
323-5178

OBJECTIVE(S): Obtain more detailed operating data on the pilot composter. Use the operating data to develop and implement a control system for the composting system. Determine if models used to describe the relationships between heat output, temperature, ventilation rate, and water removal in composition of sewage sludge are applicable to the pilot plant.

PROJECT DESCRIPTION: The City of Guelph has started a pilot-scale wet/dry recycling program and is constructing a hybrid aerated pile/in-vessel system to compost the wet stream. Determination of temperature and moisture content profiles in the reactor, inbound waste composition and compost quality are necessary to obtain accurate information on the reactor performance. The data can be used in the development of a control system, the design of full-scale composting plants, and the development of a computer model to describe and simulate the composting system.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
	Cost: (000's):	44.7	45.8		90.5
	Work Years: 2				

Budget Source: RAC

KEYWORDS: solid waste, composter

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT  
GRANT X

SOLICITED  
UNSOLICITED X

P502GCT TITLE: Bioconversion of the Mechanically  
Separable Paper Fraction of Municipal Solid Waste  
to Fuel Alcohol

PROJECT NO: 502G  
START DATE: 04/90

SHORT TITLE: Bioconversion of Solid Waste to Fuel Alcohol

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. M. Wayman  
University of Toronto

LIAISON OFFICER (name, location, telephone no.): D.M. Ianesu  
Waste Management Branch  
323-5190

OBJECTIVE(S): Determine the light fraction of MSW's potential for  
saccharification and for production of alcohol. Measure volume reduction, and  
make a mass balance of the process. Measure yields and enzyme requirements. Study  
processes for on-site manufacture of cellulase enzymes. Prepare a report which  
summarizes the results for this work, and considers the economic and technical  
factors in scale-up.

PROJECT DESCRIPTION: This project is directed to reducing the volume of MSW now  
going to landfill, and the bioconversion of its paper content to a marketable  
product, the environmentally benign motor fuel alcohol (ethanol). The process  
begins with enzymatic saccharification of cellulose, the largest component of the  
paper, followed by fermentation to ethanol. The proposal also includes study of  
a process for in-plant low-cost enzyme production.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
	Cost: (000's):	47.0	49.0		96.0
	Work Years: 2				

Budget Source: RAC

KEYWORDS: solid waste, fuel alcohol, bioconversion

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the  
Ministry. Please indicate budget source by organization (e.g. RAC, OPAC,  
Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT X  
GRANT

SOLICITED  
UNSOLICITED X

PROJECT TITLE: Development of an Enzyme Immunoassay  
for the Rapid Detection and Quantification of  
Glyphosate

PROJECT NO: 503C  
START DATE: 04/90

SHORT TITLE: Enzyme Immunoassay/Rapid Detection

PRINCIPAL INVESTIGATOR AND AFFILIATION: Mr. Claude J. Morin  
Paracel Laboratories

LIAISON OFFICER (name, location, telephone no.): D. Hall  
Laboratory Services Branch  
235-5910

OBJECTIVE(S): Development of an enzyme immunoassay using polyclonal antibodies  
that could possibly, later be replaced by monoclonal antibodies.

PROJECT DESCRIPTION: Amongst the pesticides used in the Province of Ontario, N-  
(Phosphonomethyl) glycine (glyphosate) is of major importance. The use of an  
enzyme immunoassay would be of great help in i) shortening the time required for  
the analysis of glyphosate and its major metabolite, aminoethylphosphonic acid, ii)  
allowing the simultaneous analysis of many samples at the same time, and iii)  
lowering the detection limit.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
	Cost: (000's):	74.8			74.8
	Work Years: 1				

Budget Source: RAC

KEYWORDS: enzyme immunoassay, glyphosate, rapid screening

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the  
Ministry. Please indicate budget source by organization (e.g. RAC, OPAC,  
Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT  
GRANT X

SOLICITED  
UNSOLICITED X

PROJECT TITLE: Development of Techniques and  
Methodologies for the Direct Analysis of Solids  
and Difficult Samples by ICE-AES and ICP-MS

PROJECT NO: 504G  
START DATE: 04/90

SHORT TITLE: ICE-AES/ICP-MS Analysis

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. E. Salin  
McGill University

LIAISON OFFICER (name, location, telephone no.): D. Boomer  
Laboratory Services Branch  
235-5858

OBJECTIVE(S): Development of instrumentation and methodologies which provide significant improvement in elemental analysis capabilities. The proposal is concentrating in two areas ((1) reduction of sample preparation by eliminating or reducing the requirement and (2) improvement in detection limits. The approach is targeted at ICP based instrumentation (of which the MOE has 10, because they should offer good detection limits and high throughput when the work is completed.

PROJECT DESCRIPTION: Based on the University's experience (project 270), they propose the extension of their work with Direct Sample Insertion (DSI) for both ICP-AES and ICP-MS. Now the university proposes the development of methodologies for specific MOE sample types which are suitable for DSI-ICP sample introduction.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
	Cost: (000's):	37.0	39.0	41.0	117.0
	Work Years: 3				

Budget Source: RAC

KEYWORDS: ICP-AES, ICP-MS, solids analysis, direct analysis, trace metals

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)



RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT  
GRANT X

SOLICITED  
UNSOLICITED X

PROJECT TITLE: Physical Modelling of Contaminant  
Plumes from Landfills

PROJECT NO: 505G  
START DATE: 04/90

SHORT TITLE: Contaminant Plumes Modelling

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. R.J. Mitchell  
Queen's University

LIAISON OFFICER (name, location, telephone no.): C.A. Bostock  
Waste Management Branch  
323-5218

OBJECTIVE(S): To apply expertise in physical modelling of geotechnical phenomenon to the problems of contaminant transport in partly saturated soils. To produce realistic and accurate data on contaminant migration from landfills, tank leakages or spills and to develop correlations between the physical model results and numerical techniques for predicting plume development.

PROJECT DESCRIPTION: Problems of groundwater flow and contaminant transport in partly saturated soils cannot be solved using numerical techniques. Physical modelling by means of a geotechnical centrifuge offers an attractive alternative. Municipal landfills are generally sited on partly saturated soils and the prediction of potential contaminant plume development should some liner leakage occur is a problem which can be accurately modelled in Queen's geotechnical centrifuge.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
	Cost: (000's):	18.5	16.5	15.5	50.5
	Work Years: 3				

Budget Source: RAC

KEYWORDS: modelling, contaminant plumes, landfills

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT X  
GRANT

SOLICITED  
UNSOLICITED X

PROJECT TITLE: Accurate Control Testing for  
Clay Liner Permeability

PROJECT NO: 506C  
START DATE: 04/90

SHORT TITLE: Control Testing/Clay Liner

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. R.J. Mitchell  
Queen's University

LIAISON OFFICER (name, location, telephone no.): C.A. Bostock  
Waste Management Branch  
323-5218

OBJECTIVE(S): To develop a simple accurate apparatus and methodology to carry out both design and control testing of compacted clay liner permeability. Present methods are not satisfactory due to low confidence levels as a result of test leakage and long duration (up to 20 days to obtain an evaluation) which results in an unacceptable lag between installation and control evaluation.

PROJECT DESCRIPTION: In an effort to improve liner evaluation techniques, an apparatus will be developed to carry out liner permeability testing in a geotechnical centrifuge. Data from conventional triaxial permeability testing will be compared with data obtained in the centrifuge liner models in order to demonstrate the superior confidence levels obtained and reliability of the centrifuge model test.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
	Cost: (000's):	12.6			12.6
	Work Years: 1				

Budget Source: RAC

KEYWORDS: clay liner, permeability

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT  
GRANT X

SOLICITED  
UNSOLICITED X

PROJECT TITLE: Reassessment of the Efficiency of  
Market Policies for Pollution Control

PROJECT NO: 507G  
START DATE: 04/90

SHORT TITLE: Market Policies/Pollution Control

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. D.N. Dewees  
University of Toronto

LIAISON OFFICER (name, location, telephone no.): P. Blyth  
Policy & Planning Branch  
323-4686

OBJECTIVE(S): Use available data on the shape of benefit functions to identify pollutants for which the effect investigated here is substantial and important, and those for which it is relatively unimportant. Produce a summary of the situations for which considerable advantages arise from the use of economic mechanisms for pollution control. Environmental problems in Ontario where these advantages might be greatest will be identified.

PROJECT DESCRIPTION: The Environment is not perfectly mixed. Once this is recognized the theoretical advantage of effluent charges and marketable effluent rights policies, in minimizing pollution control costs, drop substantially. This study will explore the benefits that are generated when ambient pollution concentration is reduced below air quality standards, and evaluate the extent to which these benefits may offset the added costs imposed by applying a uniform market policy over an unmixed airshed.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
	Cost: (000's):	13.9			13.9
	Work Years: 1				

Budget Source: RAC

KEYWORDS: pollution control

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT  
GRANT X

SOLICITED  
UNSOLICITED X

PROJECT TITLE: Municipal Recycling Programs  
and Household Conservation Behaviour

PROJECT NO: 508G  
START DATE: 04/90

SHORT TITLE: Household Behaviour/Recycling

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. R. Kreutzwiser  
University of Guelph

LIAISON OFFICER (name, location, telephone no.): J. Petoia  
Waste Management Branch  
323-5210

OBJECTIVE(S): The study aims to inventory the extent of conservation behaviour and attitudes in a sample of Guelph households. To Test the influence of degrees of participation in recycling programs and selected and household attributes on the inventoried conservation behaviour and attitudes. To recommend strategies for enhancing conservation behaviour broadly.

PROJECT DESCRIPTION: A sample of Guelph residents participating in two recycling programs, as well as non-participants, will be interviewed to inventory household conservation behaviour, attitudes, and selected characteristics. Analysis will explore, among other potential relationships, the extent to which practical experience (learning) with recycling leads to other forms of environmentally-friendly behaviour.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
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Cost: (000's):	6.1				6.1
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Work Years: 1

Budget Source: RAC

KEYWORDS: recycling, waste management, conservation, behaviour

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT X  
GRANT

SOLICITED  
UNSOLICITED X

PROJECT TITLE: Economy-Environment Linkages and  
Sustainable Development in Ontario

PROJECT NO: 509C  
START DATE: 04/90

SHORT TITLE: Sustainable Development/Ontario

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. P.A. Victor  
VHB Research & Consulting Inc.

LIAISON OFFICER (name, location, telephone no.): J.A. Donnon  
Policy & Planning Branch  
323-4579

OBJECTIVE(S): To develop a framework that will: provide a means of quantifying economy - environment linkages in Ontario; assist the examination of sustainability of development in Ontario through scenario analysis. A secondary objective is to generate a basis for integrated provincial economy-environment accounts. To lay the groundwork for the extension of the framework to include a model of one or more renewable resources in Ontario.

PROJECT DESCRIPTION: The main tasks to be performed are: to assemble data bases on resources used and wastes by economic sector and on the population and resources at risk, to add production technologies to a regionalized input-output model, to incorporate the environmental protection sector in the input-output model as well as the data on resources and wastes, to develop scenarios and undertake scenario analysis, and to prepare a report and user manual.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
	Cost: (000's):	135.6	61.2		196.8
	Work Years: 2				

Budget Source: RAC

KEYWORDS: sustainable development, economy, environment

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT  
GRANT X

SOLICITED  
UNSOLICITED X

PROJECT TITLE: Determination of Geochemical  
Modification of Groundwater Entering Surface  
Waters from an Industrial and Municipal Disposal Site

PROJECT NO: 510G  
START DATE: 04/90

SHORT TITLE: Groundwater into Surface Waters from Disposal Sites

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. D.R. Lee  
University of Waterloo

LIAISON OFFICER (name, location, telephone no.): R. Dryan  
River's Project  
(519) 336-4030

OBJECTIVE(S): To determine the contaminant flux from two known discharge areas, one adjacent to the Algoma Steel Plant in the St. Marys River and one downgradient from either the North Bay or the Deep River municipal landfills. The long-term objective is to provide a scientific basis for regulation of groundwater-contaminant loading of surface water.

PROJECT DESCRIPTION: Continued efforts to reduce surface-water pollution require assessment of groundwater and contaminant flux. It is now possible to locate zones of contaminant flux and measure the water flux and chemical gradient in the shallow sediments of discharge zones. This topic is pertinent because without consideration of this geochemical interface, it will not be possible predict solute fluxes from zones of groundwater contamination to surface water.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
	Cost: (000's):	19.5	16.7		36.2
	Work Years: 2				

Budget Source: RAC

KEYWORDS: groundwater, disposal sites, surface waters

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT X  
GRANT

SOLICITED  
UNSOLICITED X

PROJECT TITLE: Development and Validation of a  
New, Rapid, and Economical Surrogate Bioassay  
for Industrial Contaminants

PROJECT NO: 511C  
START DATE: 04/90

SHORT TITLE: Surrogate Bioassay for Industrial Contaminants

PRINCIPAL INVESTIGATOR AND AFFILIATION: Mr. Guy L. Gilron  
Borealis Environmental Consulting

LIAISON OFFICER (name, location, telephone no.): D. Poirer  
Water Resources Branch  
235-5795

OBJECTIVE(S): To establish toxicological dose-response relationships using a novel 15-min chemotactic bioassay technique for the ciliated protist, Tetrahymena vorax, using industrial waste discharges and evaluate the predictive capability of this test by comparing it to standard bioassays using Daphnia magna and rainbow trout. The proposed study would address the need for a more inexpensive, simple, and rapid test for toxicant mixtures.

PROJECT DESCRIPTION: In light of the need for the development of predictive dose-response relationships for aquatic organisms, tests focussing on other trophic levels, for which tests are rapid and economical, merit further investigation. Although microbial communities have been used in the assessment of pollutant effects, their importance and usefulness as indicators have been generally been overlooked. We propose to develop a toxicological dose-response relationship for Tetrahymena vorax.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
	Cost: (000's):	47.9			47.9
	Work Years: 1				

Budget Source: RAC

KEYWORDS: bioassay, contaminants

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)



RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT  
GRANT X

SOLICITED  
UNSOLICITED X

PROJECT TITLE: The Effect of Farm Liquid Waste  
Application on Receiving Water Quality

PROJECT NO: 512G  
START DATE: 04/90

SHORT TITLE: Liquid Waste/Water Quality

PRINCIPAL INVESTIGATOR AND AFFILIATION: Ms. D. Dean  
Ausable Bayfield Conservation  
Authority

LIAISON OFFICER (name, location, telephone no.): M. Blackie  
London Regional Office  
(519) 611-1710

OBJECTIVE(S): Determine under which soil types and moisture conditions, the quality of receiving waters will be impaired when liquid manure is spread. Measure the efficiency of different soil types in removing bacteria. Use biotracers to determine the pathways of bacteria through the soil profile to the receiving water. Gather data that will help reduce beach closures and therefore reduce economic hardship in resort or tourist areas.

PROJECT DESCRIPTION: The first years of the study (project 430G) showed that the application of liquid manure can impair the quality of receiving water rapidly and dramatically. Data which will be collected in the second year of study will hopefully confirm the results from year one. The additional data will also be used to produce a predictor model based on the above parameters to determine a safe rate of manure application under specific field conditions.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
	Cost: (000's):	77.0			77.0
	Work Years: 1				

Budget Source: RAC

KEYWORDS: liquid waste, water quality

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT  
GRANT X

SOLICITED  
UNSOLICITED X

PROJECT TITLE: Novel Approach for the Development  
of Transgenic Plants Resistant to Pathogens:  
An Alternative to Reduce the Use of Chemical Pesticides

PROJECT NO: 513G  
START DATE: 04/90

SHORT TITLE: Transgenic Plants Resistant to Pathogens

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. M.G. AbouHaidar  
University of Toronto

LIAISON OFFICER (name, location, telephone no.): J. S. Bailey  
Hazardous Contaminants Branch  
323-5098

OBJECTIVE(S): To develop "transgenic" plants (tomato, potato, peas and impatiens) resistant to certain economically important viruses (tomato spotted wilt virus (TSWV), potato virus X (PVX), potato virus Y (PVY), clover yellow mosaic virus (CYMV) and other viruses). Another objective of this study is to make this novel approach, a model study for the development of other plants resistant not only to viruses but also to other pathogens and pests.

PROJECT DESCRIPTION: The aim of this study is to use the novel "Ribozyme" as a tool to specifically cut the viral genome and confer resistance to virus infection. Other well established molecular techniques of gene transfer, plant transformation and regeneration will be used to develop "transgenic tomato, potato and impatiens cultivars resistant to certain economically important viruses. As a result the need for chemical pesticides to control insects vectors (i.e. aphids, white flies, thrips etc.) will be drastically diminished.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
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Cost: (000's):	32.2	32.2	32.2	96.6
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Work Years: 3

Budget Source: RAC, OMAF

KEYWORDS: transgenic plant, viruses, ribozyme

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT  
GRANT X

SOLICITED  
UNSOLICITED X

PROJECT TITLE: Development of Procedures for Improved  
Data Quality for Monitoring Sewage Plants Under  
the MISA Program

PROJECT NO: 514G  
START DATE: 09/90

SHORT TITLE: MISA/Sewage Plant Monitoring

PRINCIPAL INVESTIGATOR AND AFFILIATION: P. Sly  
Canadian Association of Environmental  
Analytical Laboratories (CAEAL)

LIAISON OFFICER (name, location, telephone no.): S. Villard  
Laboratory Services Branch  
235-5748

OBJECTIVE(S): To establish a laboratory certification/accreditation process. The process and associated criteria will be used to establish the performance level of Ontario analytical laboratories. This work will facilitate the privatization program of the Ontario Government. This work will also enhance the performance and quality of private-sector laboratories, and improve their competitiveness in both the Canadian and U.S.A. markets.

PROJECT DESCRIPTION: To determine the capabilities and performance of Ontario-based laboratories that support MISA program monitoring activities for sewage treatment plants. To develop laboratory Code-of-Practice documents. To develop generalized accreditation/certification schemes and associated criteria. To establish formal mechanisms for technology transfer of new analytical and quality assurance methods to Ontario environmental laboratories.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
Cost: (000's):		151.0	62.0		213.0
Work Years:	2				

Budget Source: RAC

KEYWORDS: MISA, sewage treatment plants, QA/QC, round-robin

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: In progress.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

AIR RESOURCES BRANCH

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RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL  
INTERNAL X

Contract  
Grant

Solicited  
Unsolicited X

PROJECT TITLE: Method Development of PAH's in  
Ambient Air

PROJECT NO: 298PL  
START DATE: 03/86

SHORT TITLE: PAH's in Ambient Air

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. G. Diamond  
Air Resources Branch  
880 Bay Street  
Toronto, 326-1661

LIAISON OFFICER (name, location, telephone no.): Dr. N. Reid  
Air Resources Branch

OBJECTIVE(S): To develop a method of accurate sampling of airborne PAH  
compounds on a routine basis.

PROJECT DESCRIPTION: This a joint ARB-LSB-Regional Offices project. Various  
methods are being evaluated by both laboratory and field testing, to assess  
possible interferences, accuracy and precision.

BUDGET AND RESOURCES:	Year: (* current)	4	5*	6	TOTAL
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Cost: (\$000's):					30.0
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Work Years:

Budget Source: ARB Internal

KEYWORDS: PAH, ambient air

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the  
Ministry. Please indicate budget source by organization (e.g., RAC,  
OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL  
INTERNAL X

Contract  
Grant

Solicited  
Unsolicited

PROJECT TITLE: Method Development for Volatile  
Organics in Ambient Air

PROJECT NO: ARB  
START DATE: 03/82

SHORT TITLE: VOC Development

PRINCIPAL INVESTIGATOR AND AFFILIATION: Mr. P. Steer  
Air Resources Branch

LIAISON OFFICER (name, location, telephone no.): N. Reid  
Air Resources Branch  
326-1691

OBJECTIVE(S): To develop a method for accurate sampling of volatile organic compounds on a routine basis.

PROJECT DESCRIPTION: This is a joint ARB-LSB-Regional Offices project. The use of ambient cartridges and other sampling approaches is being evaluated by both laboratory and field testing, with a view to possible interferences, accuracy and precision.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):				50.0
	Work Years: 0.5				

Budget Source: ARB

KEYWORDS: Volatile toxic organic compounds

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL INTERNAL X	Contract Grant	Solicited Unsolicited
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PROJECT TITLE: Flouride Criteria Studies	PROJECT NO: ARB START DATE: 11/85
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SHORT TITLE: Fluoride Criteria

PRINCIPAL INVESTIGATOR AND AFFILIATION: Mr. R.D. Jones  
Phytotoxicology Section  
Controlled Environment  
Library, Brampton  
456-2504

LIAISON OFFICER (name, location, telephone no.): D.S. Harper  
Air Resources Branch  
456-2505

OBJECTIVE(S): To conduct a series of controlled environment exposures to evaluate the current (proposed) 24 gaseous fluoride criteria in air, with respect to injury to vegetation.

PROJECT DESCRIPTION: Various species of plants with known sensitivity to gaseous fluoride are being exposed to fluoride concentrations at and above lppb (v/v) (0.86ug/l) for 24 hours. Injuries resulting from these exposures are rated and the plant tissue evaluated including: Manitoba maple, plum, gladiolus, apricot, tulip, wild grape and white pine. On completion, the validity of the 24-hour criterion (lppb) will be assessed.

BUDGET AND RESOURCES:	Year: (* current)	4	5	6*	TOTAL
	Cost: (\$000's):				98.0
	Work Years:	6			

Budget Source: ARB

KEYWORDS: Fluoride, controlled exposure, vegetation

OUTPUT (papers, presentations, reports): The results will be published in a Ministry report and possibly in a referred Journal.

EXTERNAL PARTICIPATION (ministries, governments, agencies): None

COMMENTS: Report pending end of fiscal year

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).



RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL  
INTERNAL X

Contract  
Grant

Solicited  
Unsolicited

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PROJECT TITLE: Eulerian Model Evaluation Field Study      PROJECT NO: ARB  
START DATE: 06/88

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SHORT TITLE: Eulerian Model

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PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. N. Reid  
Air Resources Branch

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LIAISON OFFICER (name, location, telephone no.): Dr. M. Lusi  
Air Resources Branch

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OBJECTIVE(S): To collect special atmospheric chemistry measurements on acid-rain-related compounds, for evaluation of Eulerian long-range transport studies.

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PROJECT DESCRIPTION: Measurements of sulphur and nitrogen oxides in air and precipitation, and related compounds, are made in Dorset and a number of other sites.

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BUDGET AND RESOURCES:	Year: (* current)	1	2	3*	TOTAL
	Cost: (\$000's):				220.0
	Work Years: 3.0				

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Budget Source: ARB

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KEYWORDS: Acid rain, atmospheric chemistry

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OUTPUT (papers, presentations, reports):

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EXTERNAL PARTICIPATION (ministries, governments, agencies): USEPA, EPRI, Environment Canada, Florida Acid Department Monitoring Program.

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COMMENTS: Field measurements have been completed. Initial data sets have been delivered, and model evaluation is under way.

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL  
INTERNAL X

CONTRACT  
GRANT

SOLICITED  
UNSOLICITED

PROJECT TITLE: TAGA Method Development

PROJECT NO: ARB-1  
START DATE:

SHORT TITLE: TAGA Method Development

PRINCIPAL INVESTIGATOR AND AFFILIATION: G. De Brou  
Air Resources Branch

LIAISON OFFICER (name, location, telephone no.): M. Lusia  
Air Resources Branch  
326-1667

OBJECTIVE(S): To develop analytical methods to allow the TAGA to be applied to a range of chemical species.

PROJECT DESCRIPTION: This is an on-going program to expand the capability of the mobile TAGA system. It involves investigation of inlet conditions and ion chemistry, formation of a library and other techniques associated with CI/MS, MS/MS, etc.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
	Cost: (000's):	90.0			90.0
	Work Years:	0.75			

Budget Source: Air Resources Branch

KEYWORDS: TAGA, mobile monitoring, toxic compounds, MS/MS

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: This project has been on-going since the acquisition of the TAGA.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL  
INTERNAL X

CONTRACT  
GRANT

SOLICITED  
UNSOLICITED

PROJECT TITLE: Application of GC/MI/FTIR to  
Determination of Ambient PAH and Formaldehyde

PROJECT NO: ARB-2  
START DATE:

SHORT TITLE: FTIR Development

PRINCIPAL INVESTIGATOR AND AFFILIATION: R. Chapman  
Air Resources Branch

LIAISON OFFICER (name, location, telephone no.): R. Bell  
Air Resources Branch  
326-1670

OBJECTIVE(S):  
To expand the capability of the Air Resources Branch in monitoring airborne  
pollutants.

PROJECT DESCRIPTION:

Methods development for the gas chromatography/matrix isolation/fourier transform  
infrared spectrometer system to provide a technique complementary to mass  
selective detection. Specific application to PAH and formaldehyde. Methods of  
sampling and sample delivery. Formation of compound library.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
	Cost: (000's):	25.0			25.0
	Work Years: 1				

Budget Source: Air Resources Branch

KEYWORDS: PAH, formaldehyde, FTIR

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the  
Ministry. Please indicate budget source by organization (e.g. RAC, OPAC,  
Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL  
INTERNAL X

CONTRACT  
GRANT

SOLICITED  
UNSOLICITED

PROJECT TITLE: Application of ADOM to the  
Transport and Deposition of Mercury

PROJECT NO: ARB-3  
START DATE:

SHORT TITLE: Mercury Modelling

PRINCIPAL INVESTIGATOR AND AFFILIATION: C. Fung  
Air Resources Branch

LIAISON OFFICER (name, location, telephone no.): P. Misra  
Air Resources Branch  
235-5768

OBJECTIVE(S):

To predict the transport and deposition of mercury in eastern North America using ADOM.

PROJECT DESCRIPTION:

The ADOM model will be modified to allow its application to the emission, transport and deposition of mercury. Determination of the direct atmospheric input of mercury to water bodies, such as the great Lakes is of particular interest.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
	Cost: (000's):	20.0			20.0
	Work Years: 0.5				

Budget Source: Air Resources Branch

KEYWORDS: model, mercury, ADOM

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

HAZARDOUS CONTAMINANTS COORDINATION BRANCH

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RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL  
INTERNAL

Contract  
Grant

Solicited  
Unsolicited

PROJECT TITLE: Exposure Studies in the Use of  
Pesticides in the Home Garden  
and for Landscape Pest Control

PROJECT NO: HCCB  
START DATE:

SHORT TITLE: Use of Pesticides - Home Garden/Landscape

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. K. Solomon  
Canadian Centre for  
Toxicology

LIAISON OFFICER (name, location, telephone no.): J. Onderdonk/J. Lucas  
Hazardous Contaminants Branch  
323-5099/323-5111

OBJECTIVE(S): Contractor will address exposure of professional applicators,  
homeowners and bystanders.

PROJECT DESCRIPTION: Pesticide exposure studies under field conditions will be  
carried out to define professional applicator, homeowners, bystander exposure  
and to define means to reduce exposure.

BUDGET AND RESOURCES:	Year: (* current)	1	2*	3	TOTAL
	Cost: (\$000's):	11.0	98.6	99.8	209.4
	Work Years:	7.5			

Budget Source: HCCB

KEYWORDS: exposure studies on pesticides

OUTPUT (papers, presentations, reports): progress reports, final report,  
scientific papers.

EXTERNAL PARTICIPATION (ministries, governments, agencies): peer review by  
Health and Welfare Canada.

COMMENTS: In progress. Project will be completed by March 1991.

NOTE: "External" refers to projects carried out by investigators outside the  
Ministry. Please indicate budget source by organization (e.g., RAC,  
OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT  
GRANT X

SOLICITED  
UNSOLICITED X

PROJECT TITLE: Persistence, Leaching and Bio-  
availability of Inorganic and Pentachlorophenol  
Wood Preservatives

PROJECT NO: PO#A04809  
START DATE: 01/88

SHORT TITLE: Wood Preservatives

PRINCIPAL INVESTIGATOR AND AFFILIATION: K. Solomon  
Canadian Centre for Toxicology

LIAISON OFFICER (name, location, telephone no.): G. Cutten  
Hazardous Contaminants Branch  
323-5117

OBJECTIVE(S): Study the potential human exposure and ecological importance of the  
potential dislodgeability of residues of PCP and inorganic preservatives.

PROJECT DESCRIPTION: The project will cover several priorities: 1. Leaching from  
treated lumber into water of inorganics and effect of acid precipitation on  
leaching into water. 2. Leaching of PCP from treated wood and movement in soil.  
3. Aquatic toxicology of leachates and individual components. 4. Human bystander  
exposure to PCP leachates.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3 *	TOTAL
	Cost: (000's):	10.2	32.5	34.4	77.1
	Work Years: 3				

Budget Source: Hazardous Contaminants Branch

KEYWORDS: wood preservatives, inorganic, PCP pentachlorophenol, bystander  
exposure

OUTPUT (papers, presentation, reports): Interim Reports July 1988, April 1989,  
September 1989, and December 1989.

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: This project has also initiated research projects through CCT funded  
by Canadian Electrical Association and Ontario Hydro Re: PCP and CCA use in  
utility poles.

NOTE: "External" refers to projects carried out by investigators outside the  
Ministry. Please indicate budget source by organization (e.g. RAC, OPAC,  
Branch, etc.)



LABORATORY SERVICES BRANCH

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RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT X  
GRANT

SOLICITED  
UNSOLICITED

PROJECT TITLE: Source Identification of Air  
Borne Particulates of Environmental Concern Using  
Surface and Microchemical Techniques

PROJECT NO: ITC-E-8802  
START DATE: 08/88

SHORT TITLE: Source Identification of Air Particulates

PRINCIPAL INVESTIGATOR AND AFFILIATION: R.R. Martin  
University of Western Ontario

LIAISON OFFICER (name, location, telephone no.): J. Hipfner/R. Moody  
Laboratory Services Branch  
235-5856

OBJECTIVE(S): To develop a series of instrumental tests which may be used to  
identify specific sources of airborne particulates. The environmental toxicity  
will also be assessed.

PROJECT DESCRIPTION: This project will provide MOE with an expanded capability  
for identification of air particulates relating to sources; has application toward  
complaint investigations and long range air transport of particulates. University  
of Western Ontario will be utilizing the resources of the Surface Science Centre  
which received funding recently by the Ontario Government as a Centre of  
Excellence. The work will be done by an MSc student who will work closely with  
Laboratory Services Branch staff.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3 *	TOTAL
	Cost: (000's):	8.6	42.9	37.4	88.9
	Work Years: 3				

Budget Source: Laboratory Services Branch

KEYWORDS: airborne particulates, characterization

OUTPUT (papers, presentation, reports): 1. "The Use of Surface Science  
Techniques in the Characterization of Inhaleable Air Particulates", R. Martin, J.  
Hipfner and R. Moody, Presented at CIC Conference, Victoria, B.C., June 1989.  
2. "Catalytic Properties of Air Particulates", J. Hipfner, R. Martin. Presented  
at the Canadian Chemical Congress, Halifax, N.S. July 1990.

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: This project is part of the Lab/University Joint Research Venture  
Program. Completion date is August 28, 1991.

NOTE: "External" refers to projects carried out by investigators outside the  
Ministry. Please indicate budget source by organization (e.g. RAC, OPAC,  
Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL  
INTERNAL X

CONTRACT  
GRANT

SOLICITED  
UNSOLICITED

PROJECT TITLE: Ultratrace Metal Analysis by  
IC-MS using Column Preconcentration

PROJECT NO: ITC-I-8801  
START DATE: 01/89

SHORT TITLE: IC-ICP/MS

PRINCIPAL INVESTIGATOR AND AFFILIATION: M. Powell/J. Hipfner  
Inorganic Trace Contaminants Section  
Laboratory Services Branch

LIAISON OFFICER (name, location, telephone no.): M. Powell/J. Hipfner  
Laboratory Services Branch  
235-5894

OBJECTIVE(S): To develop and optimize an IC-ICP/MS for select trace elements and  
to use preconcentration with IC-ICP/MS to reduce detection limits.

PROJECT DESCRIPTION: An ion chromatograph will be coupled to an IC-ICP/MS  
instrument, and the system optimized for Pb, Cd, and Cu. The column will be used  
to preconcentrate these and possibly other trace metals, for subsequent  
measurement by ICP/MS.

BUDGET AND RESOURCES:	Year: (* current)	1	2 *	3	TOTAL
	Cost: (000's):	16.0	25.0	25.0	66.0
	Work Years: 0.6				

Budget Source: Laboratory Services Branch

KEYWORDS: ICP/MS, IC, IC-ICP/MS, preconcentration, water analysis

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: Research in support of Water Resources Branch, Dorset Program.  
Completion date is June 1, 1991.

NOTE: "External" refers to projects carried out by investigators outside the  
Ministry. Please indicate budget source by organization (e.g. RAC, OPAC,  
Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL  
INTERNAL X

CONTRACT  
GRANT

SOLICITED  
UNSOLICITED

PROJECT TITLE: The Application of ICP/MS for  
the Analysis of Metals in Surface Waters

PROJECT NO: ITC-I 8901  
START DATE: 07/89

SHORT TITLE: ICP/MS Surface Waters

PRINCIPAL INVESTIGATOR AND AFFILIATION: M. Powell/E. Quan  
Inorganic Trace Contaminants Section  
Laboratory Services Branch

LIAISON OFFICER (name, location, telephone no.): M. Powell/E. Quan  
Laboratory Services Branch  
235-5834

OBJECTIVE(S): To assess the feasibility of using ICP/MS for the analysis of  
surface water samples on a routine basis.

PROJECT DESCRIPTION: Data from previous analysis of routine surface water samples  
submitted to MOE will be summarized. Experiments will be carried out to determine  
the limitations of ICP/MS for these samples. A tentative methods using matrix  
matching, internal standards, and appropriate instrument settings will be devised  
and tested. Sample screening and data routing procedures will be implemented as  
necessary.

BUDGET AND RESOURCES:	Year: (* current)	1	2 *	3	TOTAL
	Cost: (000's):	30.0	30.0		60.0
	Work Years: 1				

Budget Source: Laboratory Services Branch

KEYWORDS: ICP/MS, water analysis

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: Research in support of Water Resources Branch programs. Completion  
date is March 31, 1991.

NOTE: "External" refers to projects carried out by investigators outside the  
Ministry. Please indicate budget source by organization (e.g. RAC, OPAC,  
Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL  
INTERNAL X

CONTRACT  
GRANT

SOLICITED  
UNSOLICITED

PROJECT TITLE: Stability Study of Dibenzo-p-dioxins  
and Dibenzofurans in Fish During Storage

PROJECT NO: DWO-I-8703  
START DATE: 01/87

SHORT TITLE: Dioxins/Furans in Stored Fish Samples

PRINCIPAL INVESTIGATOR AND AFFILIATION: C. Tashiro  
Drinking Water Organics Section  
Laboratory Services Branch

LIAISON OFFICER (name, location, telephone no.): C. Tashiro  
Laboratory Services Branch  
235-5897

OBJECTIVE(S): To determine the effect of freezer storage time on analytical results.

PROJECT DESCRIPTION: Up to two years or more can elapse before ground fish samples are analyzed. This study is needed to determine whether the analytical results obtained are consistent over this time period.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3 *	TOTAL
Cost: (000's):		21.0	10.0	10.0	41.0
Work Years:	0.9				

Budget Source: Laboratory Services Branch

KEYWORDS: fish, storage, dioxin

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: Work is required to support Water Resources Branch - Fish Contaminants Program. Samples have been stored for three years. Extracted samples will be analyzed by April, 1990. Report is to be completed by July, 1991. Completion date is July 30, 1991.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT X  
GRANT

SOLICITED  
UNSOLICITED

PROJECT TITLE: Development of an Automated HPLC  
System for the Extraction and Determination  
of Multiresidues from Water Samples

PROJECT NO: DWO-E-8801  
START DATE: 06/88

SHORT TITLE: Automated HPLC System for Multiresidues

PRINCIPAL INVESTIGATOR AND AFFILIATION: I. Brindle/D. Chiba  
Department of Chemistry  
Brock University

LIAISON OFFICER (name, location, telephone no.): D. Hall  
Laboratory Services Branch  
235-5910

OBJECTIVE(S): To develop an automated High Pressure Liquid Chromatographic (HPLC) System method to replace the use of liquid/liquid extract and improved the automatic of solid phase extraction techniques for the analysis of organophosphate compounds in water.

PROJECT DESCRIPTION: The project is intended to develop a HPLC to directly concentrate and separate various groups of organic parameters for analysis of surface waters. Such a system would eliminate the need for laborious extraction and concentration steps. The major groups which would be investigated include organochlorine pesticides and triazine herbicides. The work will be done by an MSc student who will work closely with Laboratory Services Branch staff.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3 *	TOTAL
	Cost: (000's):	67.9	32.6	53.9	154.0
	Work Years: 3				

Budget Source: Laboratory Services Branch

KEYWORDS: HPLC, multiresidues

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: This project is part of the Laboratory/University Joint Research Venture Program. Completion date is June 7, 1991.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)



RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL  
INTERNAL X

CONTRACT  
GRANT

SOLICITED  
UNSOLICITED

PROJECT TITLE: Accuracy & Reproducibility of  
Compound Identification by GC-MS  
(Round-Robin Study)

PROJECT NO: DWO-I-8902  
START DATE: 07/90

SHORT TITLE: GC-MS Characterization Round-Robin

PRINCIPAL INVESTIGATOR AND AFFILIATION: C. Tashiro  
Drinking Water Organics Section  
Laboratory Services Branch

LIAISON OFFICER (name, location, telephone no.): C. Tashiro  
Laboratory Services Branch  
235-5897

OBJECTIVE(S): To investigate the accuracy and reproducibility of organic compound identification in complex environmental samples.

PROJECT DESCRIPTION: Two or three sample types will be selected and extracted. Extracts will be spiked with a few compounds to ensure principles compounds classes are present. Aliquots of extracts will be submitted to select laboratories for characterization analysis.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
	Cost: (000's):	25.0			25.0
	Work Years:	0.2			

Budget Source: Laboratory Services Branch

KEYWORDS: round-robin, GC-MS, organic characterization

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies): private analytical laboratories, academic laboratories

COMMENTS: Completion date is December 31, 1990.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL  
INTERNAL X

CONTRACT  
GRANT

SOLICITED  
UNSOLICITED

PROJECT TITLE: Investigation of Formation of  
Dioxins/Furans in Prescribed Burns

PROJECT NO: DWO-I-8904  
START DATE: 07/88

SHORT TITLE: Dioxins in Forest Fires

PRINCIPAL INVESTIGATOR AND AFFILIATION: C. Tashiro  
Drinking Water Organics Section  
Laboratory Services Branch

LIAISON OFFICER (name, location, telephone no.): C. Tashiro  
Laboratory Services Branch  
235-5897

OBJECTIVE(S): To determine whether forest fires are a natural source to the  
environment of dioxins/furans.

PROJECT DESCRIPTION: During prescribed burns carried out in Northern Ontario,  
Laboratory Services Branch staff will sample before/after air/soil. Air Resources  
Branch staff will perform soil sampling.

BUDGET AND RESOURCES:	Year: (* current)	1	2 *	3	TOTAL
Cost: (000's):		30.0	30.0		60.0
Work Years:	0.6				

Budget Source: Laboratory Services Branch

KEYWORDS: dioxins, furans, prescribed burns, background levels

OUTPUT (papers, presentation, reports): Paper: "Dioxins and Furans in Prescribed  
Burns. Preliminary Report." Chemosphere - in press. Presentation: "Dioxins and  
Furans in Prescribed Burns at Dioxin '89 Conference, September 1989 - Toronto.

EXTERNAL PARTICIPATION (ministries, governments, agencies): Ministry of Natural  
Resources, Forestry Canada, US Forest Service, NASA.

COMMENTS: Forest fires are potentially a large source of dioxins/furans to the  
environment. This work is needed to assess this potential source. Completion date  
is December 1, 1990.

NOTE: "External" refers to projects carried out by investigators outside the  
Ministry. Please indicate budget source by organization (e.g. RAC, OPAC,  
Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL  
INTERNAL X

CONTRACT  
GRANT

SOLICITED  
UNSOLICITED

PROJECT TITLE: Dioxins and Furans in Ambient  
Air - Canadian Council of Ministers of the  
Environment - Method Development

PROJECT NO: DWO-I-9001  
START DATE: 01/89

SHORT TITLE: CCME - Dioxins in Ambient Air Method Development

PRINCIPAL INVESTIGATOR AND AFFILIATION: C. Tashiro  
Drinking Water Organics Section  
Laboratory Services Branch

LIAISON OFFICER (name, location, telephone no.): C. Tashiro  
Laboratory Services Branch  
235-5897

OBJECTIVE(S): To investigate the accuracy and reproducibility of dioxin/furan  
identification in ambient air samples.

PROJECT DESCRIPTION: Two to three samples will be provided to government and  
contract labs for dioxin/furan analysis. Two round robins will be carried out to  
determine improvements in private lab capabilities.

BUDGET AND RESOURCES:	Year: (* current)	1	2 *	3	TOTAL
	Cost: (000's):	20.0	20.0		40.0
	Work Years: 0.4				

Budget Source: Laboratory Services Branch

KEYWORDS: dioxin, furan ambient air, round robin

OUTPUT (papers, presentation, reports): One paper printed in Chemosphere;  
presentation and Dioxin '89 and final method report expected.

EXTERNAL PARTICIPATION (ministries, governments, agencies): Environment Canada

COMMENTS: Development of a national method for dioxins/furans in ambient air.  
Completion date is December 31, 1990.

NOTE: "External" refers to projects carried out by investigators outside the  
Ministry. Please indicate budget source by organization (e.g. RAC, OPAC,  
Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL  
INTERNAL X

CONTRACT  
GRANT

SOLICITED  
UNSOLICITED

PROJECT TITLE: Liquid Chromatography/Mass  
Spectrometry (LC-MS)

PROJECT NO: DWO-I-9002  
START DATE: 07/90

SHORT TITLE: On-Line Liquid Chromatography/Mass Spectrometry (LC/MS)

PRINCIPAL INVESTIGATOR AND AFFILIATION: V. Taguchi  
Drinking Water Organics Section  
Laboratory Services Branch

LIAISON OFFICER (name, location, telephone no.): V. Taguchi  
Laboratory Services Branch  
235-5902

OBJECTIVE(S): To provide on-line LC/MS analysis of extractable organics that are not detected by GC/MS.

PROJECT DESCRIPTION: To acquire one LC/MS interface in each of the three years. To develop, using EI, CI, and FAB ionization techniques, on-line LC/MS analyses of selected extractable organics.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
	Cost: (000's):	80.0	80.0	80.0	240.0
	Work Years: 3				

Budget Source: Laboratory Services Branch

KEYWORDS: liquid chromatography/mass spectrometry (LC/MS)

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: Completion date is March 1, 1993.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL  
INTERNAL X

CONTRACT  
GRANT

SOLICITED  
UNSOLICITED

PROJECT TITLE: Hi-Vol Sampler and Field  
Validation for Polyaromatic Hydrocarbons  
and Related Structures

PROJECT NO: TO-I-8802  
START DATE: 09/88

SHORT TITLE: PAH Field Validation

PRINCIPAL INVESTIGATOR AND AFFILIATION: J. Newdick/B. Foster  
Trace Organics Section  
Laboratory Services Branch

LIAISON OFFICER (name, location, telephone no.): J. Newdick/B. Foster  
Laboratory Services Branch  
235-5758

OBJECTIVE(S): To evaluate sampling behaviour parameters such as loading, breakthrough, chemical behaviour and recovery of PAHs on XAD-2 sorbant with respect to sample volume. To evaluate relationships between meteorological events and the chemical behaviour of PAHs. Factors such as ambient seasonal temperature and their oxidative transformation by NOx/O3 into heterocyclic species will be investigated.

PROJECT DESCRIPTION: Three co-located Hi-Vol samplers will be evaluated for time trials from 24 - 72 hours operation periods with ambient air and deuterated surrogate standards.

BUDGET AND RESOURCES:	Year: (* current)	1	2 *	3	TOTAL
Cost: (000's):		4.0	8.0	8.0	20.0
Work Years:	0.5				

Budget Source: Laboratory Services Branch

KEYWORDS: PAH breakthrough, chemical behaviour, XAD-2, climate

OUTPUT (papers, presentation, reports): Paper presentation in September at Batelle, Ohio.

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: Completion date is March 31, 1991.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL  
INTERNAL X

CONTRACT  
GRANT

SOLICITED  
UNSOLICITED

PROJECT TITLE: Development of Method for the  
Analysis of Base/Neutral and Phenolic Compounds  
in (MISA Test Groups 19, 20) Municipal Sewage Sludge

PROJECT NO: TO-I 8903  
START DATE: 05/89

SHORT TITLE: Method - Sludge Analysis (Base/Neutral and Phenolics)

PRINCIPAL INVESTIGATOR AND AFFILIATION: A. Alfieri/M. McConnen  
Trace Organics Section  
Laboratory Services Branch

LIAISON OFFICER (name, location, telephone no.): A. Alfieri/M. McConnen  
Laboratory Services Branch  
235-6001

OBJECTIVE(S): To develop method for the analysis of base/neutral and phenolic  
compounds in municipal sludge.

PROJECT DESCRIPTION: The project involves the following: 1) Evaluate various  
techniques, e.g. NP, RP, GPC for the clean-up of sludge extracts. Select an  
appropriate technique and establish elution pattern for compounds which are under  
investigation; 2) Establish extraction procedure for municipal sludges with  
varying solid contents; 3) Apply the existing in-situ acetylation procedure if  
required to various sludge extract; 4) Establish recovery, MDLs and QC data as  
required by the Laboratory Services Branch/MOE; and 5) Write a method report.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
	Cost: (000's):	95.0			95.0
	Work Years: 1				

Budget Source: Laboratory Services Branch

KEYWORDS: base, neutral and phenolic organics, analysis, municipal sludge

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: The method is required for MISA-STP analysis. Completion date is May  
31, 1990.

NOTE: "External" refers to projects carried out by investigators outside the  
Ministry. Please indicate budget source by organization (e.g. RAC, OPAC,  
Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL  
INTERNAL X

CONTRACT  
GRANT

SOLICITED  
UNSOLICITED

PROJECT TITLE: Routine Method for the Analysis  
of Resin and Fatty Acids in Sediments

PROJECT NO: TO-I-8904  
START DATE: 09/90

SHORT TITLE: Resin and Fatty Acids in Sediments

PRINCIPAL INVESTIGATOR AND AFFILIATION: R. Lega  
Trace Organics Section  
Laboratory Services Branch

LIAISON OFFICER (name, location, telephone no.): R. Lega  
Laboratory Services Branch  
235-5756

OBJECTIVE(S): To establish method for the routine analysis of resin and fatty acids in sediments, targeting parameters required for MISA Pulp and Paper analysis.

PROJECT DESCRIPTION: The project may involve the following: 1) Establish an appropriate extraction procedure; 2) Derivatize the extract in order to improve chromatography and sensitivity of the method; 3) Establish clean-up of the extract; 4) Determine instrumental parameters for the analysis; 5) Establish recovery, MDLs and QC data as required by the Laboratory Services Branch/MOE; and 6) Write a method report.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
	Cost: (000's):	25.0			25.0
	Work Years: 0.5				

Budget Source: Laboratory Services Branch

KEYWORDS: resin fatty acids, sediments, pulp and paper

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: Completion date is March 1, 1991.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)



RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL  
INTERNAL X

CONTRACT  
GRANT

SOLICITED  
UNSOLICITED

PROJECT TITLE: Broad Range Screening Method for  
the Analysis of Phenols and Related Compounds in  
Sediments

PROJECT NO: TO-I-8905  
START DATE: 10/90

SHORT TITLE: Analysis of Phenols and Related Compounds in Sediments

PRINCIPAL INVESTIGATOR AND AFFILIATION: R. Lega  
Trace Organics Section  
Laboratory Services Branch

LIAISON OFFICER (name, location, telephone no.): R. Lega  
Laboratory Services Branch  
235-5756

OBJECTIVE(S): To develop an analytical method for the analysis of a broad range  
of phenols, catechols and guaicolis in a sediment matrix.

PROJECT DESCRIPTION: The project may involve the following: 1) Establish an  
appropriate extraction procedure; 2) Derivatize the extract in order to improve  
chromatography and sensitivity of the method; 3) Establish clean-up of the  
extract; 4) Determine instrumental parameters for this analysis; 5) Establish  
recovery, MDLs, and QC data as required by the Laboratory Services Branch/MOE; 6)  
Write a method report.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
	Cost: (000's):	25.0			25.0
	Work Years:	0.5			

Budget Source: Laboratory Services Branch

KEYWORDS: phenols, guaicolis, catechols, sediments

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the  
Ministry. Please indicate budget source by organization (e.g. RAC, OPAC,  
Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL  
INTERNAL X

CONTRACT  
GRANT

SOLICITED  
UNSOLICITED

PROJECT TITLE: Method Development for VOST  
and VOC Cartridges

PROJECT NO: TO-I-8906  
START DATE: 01/89

SHORT TITLE: Analysis of VOST Cartridges

PRINCIPAL INVESTIGATOR AND AFFILIATION: L. Au  
Trace Organics Section  
Laboratory Services Branch

LIAISON OFFICER (name, location, telephone no.): L. Au  
Laboratory Services Branch  
235-6000

OBJECTIVE(S): To develop an analytical method for VOST samples, and establish GC/MSD method for the analysis of volatile organic compounds (VOC).

PROJECT DESCRIPTION: Develop GC-MSD/thermal desorption method to analyze VOST type cartridge and ambient air samples. The target compounds are hydrocarbons and chlorinated hydrocarbons (boiling point between 50 & -150 degrees celsius).

BUDGET AND RESOURCES:	Year: (* current)	1	2 *	3	TOTAL
Cost: (000's):		40.0	22.0	22.0	84.0
Work Years:	2.0				

Budget Source: Laboratory Services Branch

KEYWORDS: VOST, VOC, cartridges, chlorinated, hydrocarbons

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: Completion date is January 1, 1991.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL  
INTERNAL X

CONTRACT  
GRANT

SOLICITED  
UNSOLICITED

PROJECT TITLE: Development of Method for the  
Analysis of Chlorophenols, PCB, PAH, & CB  
in Stack Samples

PROJECT NO: TO-I-8907  
START DATE: 11/87

SHORT TITLE: Stack Analysis

PRINCIPAL INVESTIGATOR AND AFFILIATION: R. Luniewski  
Trace Organics Section  
Laboratory Services Branch

LIAISON OFFICER (name, location, telephone no.): R. Luniewski  
Laboratory Services Branch  
235-6000

OBJECTIVE(S): To develop an extraction procedure suitable for the organics  
CB/PCB/PAH/CP. Establish appropriate derivatization of the extract in order to  
increase sensitivity of the method.

PROJECT DESCRIPTION: The project involves the following: 1) Establish an  
extraction procedure; evaluate soxhlet extraction followed by methylation  
procedure vs in-situ acetylation/extraction of organics from XAD-2-Resin; 2)  
Establish appropriate clean-up of the extract; 3) Determine instrumental  
parameters for the analysis; 4) Establish recovery, MDLs and QC data as required  
by the Laboratory Services Branch/MOE; and 5) Write a method report.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3 *	TOTAL
	Cost: (000's):	5.0	40.0	33.0	78.0
	Work Years: 1.9				

Budget Source: Laboratory Services Branch

KEYWORDS: stack

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: Completion date is March 31, 1990.

NOTE: "External" refers to projects carried out by investigators outside the  
Ministry. Please indicate budget source by organization (e.g. RAC, OPAC,  
Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL  
INTERNAL X

CONTRACT  
GRANT

SOLICITED  
UNSOLICITED

PROJECT TITLE: Oxidation of Sulphur Compounds  
and Detection as Sulphate by Ion Chromatography

PROJECT NO: WQ-I-9002  
START DATE: 11/88

SHORT TITLE: Oxidizable Sulphur

PRINCIPAL INVESTIGATOR AND AFFILIATION: F. Lo  
Water Quality Section  
Laboratory Services Branch

LIAISON OFFICER (name, location, telephone no.): F. Lo  
Laboratory Services Branch  
235-5875

OBJECTIVE(S): To develop a method for determination of sulphur by using ion chromatography.

PROJECT DESCRIPTION: Oxidize sulphur to sulphate by using hydrogen peroxide and ultraviolet light in a continuous flow system. Determine sulphate concentration by automated ion chromatography.

BUDGET AND RESOURCES:	Year: (* current)	1	2 *	3	TOTAL
	Cost: (000's):	4.0	16.0		20.0
	Work Years: 0.2				

Budget Source: Laboratory Services Branch

KEYWORDS: total sulphur, organosulphur, oxidizable sulphur

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: The sulphate concentrations were compared with the total sulphur results of ICP-AES. Completion date is February 28, 1990.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL  
INTERNAL X

CONTRACT  
GRANT

SOLICITED  
UNSOLICITED

PROJECT TITLE: Development of an Image Analyzer  
for the Enumeration of Bacterial Colonies on  
Membrane Filters

PROJECT NO: WQ-I-9003  
START DATE: 01/90

SHORT TITLE: Image Analyzer Study

PRINCIPAL INVESTIGATOR AND AFFILIATION: M. Young/G. Horsnell  
Water Quality Section  
Laboratory Services Branch

LIAISON OFFICER (name, location, telephone no.): M. Young/G. Horsnell  
Laboratory Services Branch  
235-5866

OBJECTIVE(S): To develop an automated system for enumeration of bacterial  
colonies on membrane filters with Direct Computer (LIS) Input.

PROJECT DESCRIPTION: Initially work will concentrate on the Fecal Coliform  
parameter. Counts will be made of routine FC plates both by technicians and using  
the Image Analyzer. Results will be used to refine colour ranges which are  
acceptable and the necessary physical measurements required to accurately identify  
both single and multiple target colonies.

BUDGET AND RESOURCES:	Year: (* current)	1	2 *	3	TOTAL
Cost: (000's):		60.0	23.0		83.0
Work Years:	0.7				

Budget Source: Laboratory Services Branch

KEYWORDS: image analysis, enumeration, bacterial colonies, automation, DCI

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies): Nikon Canada and  
Videtics International

COMMENTS: This project would increase quality and efficiency of counting  
procedures and would be the first step in untomating the Bacti laboratory.  
Completion date is March, 31, 1991.

NOTE: "External" refers to projects carried out by investigators outside the  
Ministry. Please indicate budget source by organization (e.g. RAC, OPAC,  
Branch, etc.)

WASTE MANAGEMENT BRANCH

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RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL	X	Contract		Solicited	
INTERNAL		Grant	X	Unsolicited	X

PROJECT TITLE: Use of Whey Wastes In Manufacture  
of High Grade Protein and Lactose

PROJECT NO: IR-04-20  
START DATE: 07/88

SHORT TITLE: Whey Wastes

PRINCIPAL INVESTIGATOR AND AFFILIATION: Protose Separations Inc.  
Alan Jones

LIAISON OFFICER (name, location, telephone no.): John Smart  
Waste Management Branch  
323-5179

OBJECTIVE(S): To investigate the manufacture of high grade protein and  
lactose from whey wastes at pilot scale.

PROJECT DESCRIPTION: Production of protein and lactose from whey wastes using  
continuous moving bed ion exchange technology.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3*	TOTAL
	Cost: (\$000's):				488.0
	Work Years: 2				

Budget Source: WMB - Industrial 4Rs Program.

KEYWORDS: Whey waste; protein; lactose; ion exchange.

OUTPUT (papers, presentations, reports): Report.

EXTERNAL PARTICIPATION (ministries, governments, agencies): None.

COMMENTS: In progress.

NOTE: "External" refers to projects carried out by investigators outside the  
Ministry. Please indicate budget source by organization (e.g., RAC,  
OPAC, Branch, etc.).



RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL	X	Contract	X	Solicited	X
INTERNAL		Grant		Unsolicited	

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PROJECT TITLE: Development of a Laboratory Qualification Standard (Code) for Laboratories Analyzing Industrial Wastes	PROJECT NO: PO#A94386 START DATE: 08/86
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SHORT TITLE: Laboratory Qualification Code

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PRINCIPAL INVESTIGATOR AND AFFILIATION: Canadian Standards Assc.  
Mr. Jim Dixon  
178 Rexdale Boulevard  
Rexdale, Ontario  
M9W 1R3

LIAISON OFFICER (name, location, telephone no.): Steven Radcliffe,  
Waste Management Branch  
323-5188

---

OBJECTIVE(S): To develop a qualification standard for laboratories analyzing industrial wastes required by Ontario Regulation 309. The standard is to be developed by a consensus approach and must be capable of being used with any subsequent certification programs that the Ministry may wish to proceed with at a future date.

---

PROJECT DESCRIPTION: The qualification standard should be developed by a consultative process involving regulatory agencies, industry, testing agencies and other interested parties. It will need to address items such as minimum staff requirements, administrative and technical requirements of laboratories performing tests on industrial wastes.

---

BUDGET AND RESOURCES:	Year: (* current)	4	5	6 *	TOTAL
	Cost: (\$000's):			10.0	55.0
	Work Years: 6				

Budget Source: Waste Management Branch

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KEYWORDS: Laboratory, Qualification Code, Industrial Wastes.

---

OUTPUT (papers, presentations, reports): CSA Standard Z201 to be released.

---

EXTERNAL PARTICIPATION (ministries, governments, agencies): Technical committee which is developing the code by consensus, includes representatives from regulatory authorities, industry, academia, testing agencies and other interested parties.

---

COMMENTS: In progress.

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL	X	Contract	X	Solicited	X
INTERNAL		Grant		Unsolicited	

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PROJECT TITLE: Wood Waste Inventory of Secondary Industries in Ontario	PROJECT NO: PO#A05580
	START DATE: 08/88

---

SHORT TITLE: Wood Waste Inventory

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PRINCIPAL INVESTIGATOR AND AFFILIATION: MacLaren Engineering  
D. Hickman

---

LIAISON OFFICER (name, location, telephone no.): R. Warner  
Waste Management Branch  
323-5196

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OBJECTIVE(S): To develop an inventory of wood residues in Southern Ontario and to identify opportunities to utilize wood waste.

---

PROJECT DESCRIPTION: An inventory of Southern Ontario wood residues will be developed and proposals for utilization of wood wastes will be made.

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BUDGET AND RESOURCES:	Year: (* current)	1*	2	3	TOTAL
	Cost: (\$000's):	51.0			51.0
	Work Years:	0.4			0.4

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Budget Source: Ministry of the Environment - 75%, Ministry of Energy - 25%

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KEYWORDS: Wood Waste Inventory

---

OUTPUT (papers, presentations, reports): "Wood Waste Inventory of Secondary Industries in Ontario", final report, Data Base Inventory.

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EXTERNAL PARTICIPATION (ministries, governments, agencies): Ministry of Energy, municipalities, industry

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COMMENTS: Final report under completion.

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

WATER RESOURCES BRANCH

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RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

Contract X  
Grant

Solicited  
Unsolicited X

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PROJECT TITLE: Stripping of Volatile Organic  
Contaminants - Pilot Scale Study

PROJECT NO: WRB87-02  
START DATE: 09/89

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SHORT TITLE: Air Stripping Model

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PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. Henryk Melcer  
Environment Canada  
Wastewater Technology Center

LIAISON OFFICER (name, location, telephone no.): H. Monteith,  
Water Resources Branch  
323-4901

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OBJECTIVE(S): (1) To determine the operational factors affecting the  
stripping of volatile organics during sewage treatment.  
2) Optimize treatment process to minimize the stripping of volatile organics.

---

PROJECT DESCRIPTION: The effect of process design and operation on the  
stripping of volatile organics will be evaluated at a pilot scale plant. A  
mathematical model to describe the stripping phenomena will be  
developed/verified. Parallel studies will then be carried out at pilot and  
full-scale plants to address 'scale up' effects.

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BUDGET AND RESOURCES:	Year: (* current)	1	2*	3	TOTAL
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Cost: (\$000's):	165.0				165.0
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Work Years:

Budget Source: WRB

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KEYWORDS: volatile organic contaminants, air stripping, sewage treatment

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OUTPUT (papers, presentations, reports):

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EXTERNAL PARTICIPATION (ministries, governments, agencies):

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COMMENTS: Final report received; will be submitted for publication as MISA  
report this summer.

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NOTE: "External" refers to projects carried out by investigators outside the  
Ministry. Please indicate budget source by organization (e.g., RAC,  
OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL	X	Contract	X	Solicited	
INTERNAL	X	Grant		Unsolicited	X

PROJECT TITLE: Model Development-Food Chain &  
Fate and Transport

PROJECT NO: WRB87-05  
START DATE: 07/86

SHORT TITLE: Food Chain Transfer

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. J.A. McCorquodale  
University of Windsor

LIAISON OFFICER (name, location, telephone no.): Peter Nettleton  
Water Resources Branch  
323-4964

OBJECTIVE(S): To enhance the existing food chain sub-model for incorporation into the "WASTOX" Contaminant Fate Model. To enhance the existing "WASP IV" Fate & Transport Model. To derive procedures for applying these models to obtain "water-quality-based effluent loading limits".

PROJECT DESCRIPTION: Studies conducted on two MISA Pilot Sites (St. Mary's and St. Clair Rivers) have collected extensive ecosystem data. Development of the food chain sub-model will provide a more realistic and accurate representation of the ecosystem, as compared with previous methods. This will enable specific data needs to be identified as well as strengthen the fate and transport models used. The models will then be used in deriving "water-quality-based effluent loading limits" for key toxic chemicals.

BUDGET AND RESOURCES:	Year: (* current)	4	5*	6	TOTAL
	Cost: (\$000's):	7.0			52.0
	Work Years: 5				

Budget Source: WRB

KEYWORDS: Food chain model, fate and transport model, water-quality based loading limits

OUTPUT (papers, presentations, reports): Output from these two MISA Pilot Site contracts, include contract reports entitled:

1. "St. Clair River Fate & Transport Modelling Calibration and Testing of the WASTOX Model using Sequential Data", Draft Final Report (see note below), May 11, 1988.
2. "St. Clair River Load Allocation", Draft Final Report (see note below), 1989.

OUTPUT (papers, presentations, reports): Cont'd.

NOTE:

These two draft report were finalized, along with additional results, and work from other Branch personnel, within the "St. Clair River MISA Pilot Site Report", which is currently being reviewed within the Water Resources Branch.

3. "Procedures for Developing Biota Based Effluent Limitations for Chemical Discharges to the St. Clair River", Draft Final Report, November 12, 1989.  
(Currently undergoing review modifications).
4. "Development of Contaminant Fate & Transport Models for the St. Marys River - Phase I MISA Pilot Site Study", Final Report, April 3, 1989.  
(The "Phase II" work and report will be completed later this fiscal year.)

The writing of 1 or 2 scientific papers (joint between MOE and contractor) will likely be completed in the next year.

---

EXTERNAL PARTICIPATION (ministries, governments, agencies):

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COMMENTS: Contract budget is supplemented by \$50.0K of work performed by Water Resources Branch.

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL	X	Contract	X	Solicited
INTERNAL		Grant		Unsolicited

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PROJECT TITLE: Stripping of Volatile Organics During Sewage Treatment - at Full Scale STP's	PROJECT NO: WRB87-08 START DATE: 01/87
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SHORT TITLE: Air Stripping

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PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. Henryk Melcer  
Environment Canada  
Wastewater Technology Center

LIAISON OFFICER (name, location, telephone no.): Hugh Monteith  
Water Resources Branch  
323-4901

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OBJECTIVE(S): To investigate the significance of air stripping as a means of removing volatile organics during sewage treatment.

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PROJECT DESCRIPTION: Composite samples of liquid sewage and off-gas were collected at the aerated grit chamber and aeration tanks (for biologically treatment). Samples were analysed for the presence of volatile organics. This study was carried out at four full-scale STP's in conjunction with 40 STPs study.

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BUDGET AND RESOURCES:	Year: (* current)	1	2	3*	TOTAL
	Cost: (\$000's):				210.0
	Work Years:				

Budget Sources: Water Resources Branch

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KEYWORDS: air stripping, volatile organics, sewage treatment

---

OUTPUT (papers, presentations, reports):  
Nutrient management plans for the two lakes

- 1) Collection of Volatile Organics Emitted from Activated sludge Systems by W.K. Bedford, J. Bell and H. Melcer, Paper presented at 23rd Canadian Symp. on Water Pollution Research, Canada Centre for Inland Waters, Burlington, Ontario Feb. 18, 1988.
- 2) Emissions of Volatile Organics from Aerated Channels and Tanks by J. Bell and H. Melcer, paper presented at 1988 Joint Annual Conference of Pollution Control Association of Ontario and Air Pollution Control Association (Ontario Section), Kingston, Ontario April 17-19, 1988.



OUTPUT (papers, presentations, reports): Cont'd.

NOTE:

These two draft report were finalized, along with additional results, and work from other Branch personnel, within the "St. Clair River MISA Pilot Site Report", which is currently being reviewed within the Water Resources Branch.

3. "Procedures for Developing Biota Based Effluent Limitations for Chemical Discharges to the St. Clair River", Draft Final Report, November 12, 1989.  
(Currently undergoing review modifications).
4. "Development of Contaminant Fate & Transport Models for the St. Marys River - Phase I MISA Pilot Site Study", Final Report, April 3, 1989.  
(The "Phase II" work and report will be completed later this fiscal year.)

The writing of 1 or 2 scientific papers (joint between MOE and contractor) will likely be completed in the next year.

---

EXTERNAL PARTICIPATION (ministries, governments, agencies):

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COMMENTS: Contract budget is supplemented by \$50.0K of work performed by Water Resources Branch.

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL  
INTERNAL X

Contract  
Grant

Solicited  
Unsolicited

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PROJECT TITLE: Control of Blue-green Algae Problems  
in Southern Ontario Lakes and Reservoirs

PROJECT NO: WRB  
START DATE: 1987

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SHORT TITLE: Blue-green algae control

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PRINCIPAL INVESTIGATOR AND AFFILIATION: K. Nicholls/H. Vandermeulen  
Aquatic Biology Section  
Water Resources Branch

LIAISON OFFICER (name, location, telephone no.): K. Nicholls  
Water Resources Branch  
235-5810

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OBJECTIVE(S): To evaluate methods of eliminating blue-green algal blooms  
using biomanipulation, physical and chemical treatment of whole  
lakes and reservoirs.

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PROJECT DESCRIPTION: A variety of lake management techniques are being  
evaluated for their ability to control blue-green algae growth in several  
lakes and reservoirs in southern Ontario. These include nitrate,  
fertilization, calcium carbonate treatment, aeration/destratification and  
hypolimnetic aeration.

---

BUDGET AND RESOURCES:	Year: (* current)	1	2	3*	TOTAL
Cost: (\$000's):		130.0	130.0	130.0	390.0
Work Years:	6.5				

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Budget Source: Water Resources Branch, Inland Lakes Programme

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KEYWORDS: Blue-green algae, lake treatment

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OUTPUT (papers, presentations, reports): Reports, seminars, conferences,  
journal papers.

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EXTERNAL PARTICIPATION (ministries, governments, agencies):  
Ministry of Natural Resources  
Conservation Authorities

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COMMENTS:

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NOTE: "External" refers to projects carried out by investigators outside the  
Ministry. Please indicate budget source by organization (e.g., RAC,  
OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL	X	Contract	X	Solicited
INTERNAL		Grant		Unsolicited

PROJECT TITLE: Literature Review - Acute Toxicity  
in Municipal Sewage Effluent

PROJECT NO: WRB87-09  
START DATE:

SHORT TITLE: Toxicity Review

PRINCIPAL INVESTIGATOR AND AFFILIATION: G. Craig  
Beak Consultants Ltd

LIAISON OFFICER (name, location, telephone no.): H. Monteith,  
Water Resources Branch  
323-4901

OBJECTIVE(S): (1) To estimate the magnitude of acute toxicity problems in  
municipal STP effluent.  
2) To determine the most prevalent chemical parameters causing acute toxicity  
to aquatic organisms.

PROJECT DESCRIPTION: Acute toxicity test data developed in the past in  
Ontario STP's were assembled to determine objectives 1 and 2. U.S. EPA data  
are also being reviewed for toxicity caused by metals.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3*	TOTAL
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Cost: (\$000's):					40.0
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Work Years:

Budget Source: WRB

KEYWORDS: municipal sewage effluent, toxicity

OUTPUT (papers, presentations, reports): MISA report "Review of Aquatic  
Toxicity and Environmental Impact of Ontario Sewage Treatment Plant  
Effluents", January 1990.

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: Final report available to public.

NOTE: "External" refers to projects carried out by investigators outside the  
Ministry. Please indicate budget source by organization (e.g., RAC,  
OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL  
INTERNAL X

Contract  
Grant

Solicited  
Unsolicited

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PROJECT TITLE: Inferred pH/alkalinity History of Acid  
Sensitive Lakes Using Algal Remains  
("fossils") Preserved in Lake Sediments

PROJECT NO: WRB  
START DATE:

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SHORT TITLE: Paleolimnology of lake acidification

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PRINCIPAL INVESTIGATOR AND AFFILIATION: K. Nicholls  
Aquatic Biology Section  
Water Resources Branch  
235-5810

LIAISON OFFICER (name, location, telephone no.): K. Nicholls  
Water Resources Branch  
235-5810

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OBJECTIVE(S): To determine the rate of change of alkalinity/pH in selected  
lakes over the past 100 years.

---

PROJECT DESCRIPTION: Calibration equations using three groups of organisms  
(diatoms, silica-scaled chrysophytes and chrysophyte cysts) have been  
developed for 50 Ontario lakes. These are now being applied to the down-core  
history of 8 lakes to determine the acidification rate.

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BUDGET AND RESOURCES:	Year: (* current)	1	2	3*	TOTAL
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Cost: (\$000's):	30.0	30.0	30.0	90.0
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Work Years: 3

Budget Source: APIOS

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KEYWORDS: Acidification, paleolimnology, sediments, algae

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OUTPUT (papers, presentations, reports): Reports, seminars, conferences,  
journal papers.

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EXTERNAL PARTICIPATION (ministries, governments, agencies):  
Queen's University, private sector consultants

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COMMENTS:

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NOTE: "External" refers to projects carried out by investigators outside the  
Ministry. Please indicate budget source by organization (e.g., RAC,  
OPAC, Branch, etc.).

REGIONAL PROJECTS

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RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X	Contract N/A	Solicited	
INTERNAL	Grant	Unsolicited	X

PROJECT TITLE: Trace Metals and Phosphorus Speciation Studies of the Sediments of the Bay of Quinte, Lake Ontario	PROJECT NO: SEREG START DATE: 10/87
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SHORT TITLE: Trace Metals in Bay of Quinte Sediments

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. Gary VanLoon  
Chemistry Department  
Queen's University

LIAISON OFFICER (name, location, telephone no.): Murray German, Chief  
Southeast Region  
(613) 549-4000

OBJECTIVE(S):

- 1) To provide information on the distribution of arsenic, copper, cobalt, nickel, lead, zinc and phosphorus among the components of the Bay sediment.
- 2) Additional information to determine the process of phosphorus release from the sediments.
- 3) Understanding of each element's affect on biological productivity of the Bay.

PROJECT DESCRIPTION:

Sediment core samples were to be collected from sites which reflect: 1) different types of sedimentary deposits (clay, organic oversand, organic and, 2) different man-use on-shore impacting on local water quality. Other parameters sampled include: 1. pH, Eh and DO of the interphase water and pore water, 2. sediment description, 3. sediment particle size, 4. organic matter content of the sediments, 5. inorganic C and CaCO<sub>3</sub> contents of the sediments, and 6. sediment abundance of the fractions and predict metal mobility across the sediment solution interface under defined environmental conditions.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3*	TOTAL
	Cost: (\$000's):				**
	Work Years: 3				
Budget Source:	Technical Support Unit, Surface Water Section Southeast Region, Kingston				

KEYWORDS: trace metals, phosphorus, Bay of Quinte, sediments

OUTPUT (papers, presentations, reports): Report "Trace Metals and Phosphorus Speciation Studies of the Sediments of the Bay of Quinte, Lake Ontario" printed.

EXTERNAL PARTICIPATION (ministries, governments, agencies): Project Quinte - Bay of Quinte Remedial Action Plan - Queen's University, King.

COMMENTS: \*\*MOE - Technical Support, Southeast Region funding of this project is provided in the form of manpower, equipment and supplies. No direct funds have been provided.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT X  
GRANT

SOLICITED X  
UNSOLICITED

PROJECT TITLE: Feasibility of Re-establishing  
Aquatic Macrophytes in the Bay of Quinte

PROJECT NO: PO#A01850  
START DATE: 12/87

SHORT TITLE: Macrophyte Re-establishment

PRINCIPAL INVESTIGATOR AND AFFILIATION: A.D. Revill Associates Ltd.  
P.O. Box 905, Belleville

LIAISON OFFICER (name, location, telephone no.): G. Owen  
Southeastern Region  
(613) 549-4000

OBJECTIVE(S): Determine the factors influencing the loss, re-establishment and growth of aquatic vegetation in the Bay. Trial establishment of several different species of aquatic plants to measure plant survival under changing conditions. Determine whether large scale planting of aquatic vegetation in the Bay is feasible.

PROJECT DESCRIPTION: The project was intended to examine the macrophyte beds in various locations around the Bay, determine which factors were influencing or restricting plant growth, and undertake an experimental transplanting of plants from areas rich in plant biomass/diversity to areas devoid or limited in plant life. The results would indicate the feasibility of large-scale transplanting and identify locations for possible future transplant work.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3 *	TOTAL
Cost: (000's):					15.1
Work Years:	3				

Budget Source: Bay of Quinte Remedial Action Plan

KEYWORDS: macrophyte, growth, Bay of Quinte, aquatic plant, re-establishment

OUTPUT (papers, presentation, reports): "Feasibility of Re-establishing Aquatic Macrophytes in the Bay of Quinte", report printed.

EXTERNAL PARTICIPATION (ministries, governments, agencies): Dr. Adele Crowder

COMMENTS: Phosphorus release from the Bay of Quinte is recognized as an increasingly important component of the eutrophication problem in the Bay. This work was undertaken as one option in controlling sediment disturbances and thus resuspension.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)



RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT X  
GRANT

SOLICITED  
UNSOLICITED X

PROJECT TITLE: A Survey of the Macrophytes  
in the Bay of Quinte

PROJECT NO: PO#A04512  
START DATE: 05/88

SHORT TITLE: Macrophyte mapping of the Bay of Quinte littoral zone

PRINCIPAL INVESTIGATOR AND AFFILIATION: A. Crowder  
Biology Department  
Queen's University

LIAISON OFFICER (name, location, telephone no.): F. Stride  
Southeastern Region  
(613) 549-4000

OBJECTIVE(S): Survey (map and speciation) of emergent and submergent aquatic plants in the Bay of Quinte littoral zone. Compare survey findings to other measurable parameters of water quality in an effort to estimate recent water quality and ecosystem changes. Compare findings to historical biomass and species data to record recent changes in macrophyte beds in the littoral zone.

PROJECT DESCRIPTION: Project Quinte has a number of transects for its routine water quality monitoring program. Emergent and submergent aquatic plants in the littoral zone will be sampled along the historical transects lines three times. Estimations of plant biomass will be contracted. As well, the different species of plants will be identified. These results will be compared, to historical data, and recent changes in water quality, as measured by the extent and types of macrophyte beds, will be determined.

BUDGET AND RESOURCES:	Year: (* current)	1	2 *	3	TOTAL
Cost: (000's):					7.0
Work Years:	2				

Budget Source: Bay of Quinte Remedial Action Plan (RAP)

KEYWORDS: macrophyte, littoral zone, biomass, speciation, mapping, Bay of Quinte

OUTPUT (papers, presentation, reports): "A Survey of the Macrophytes in the Bay of Quinte", reported printed.

EXTERNAL PARTICIPATION (ministries, governments, agencies): Royal Military College - Kingston (divers-samplers)

COMMENTS: Loss of wetlands (both emergent and submergent) continues to be a problem in the Bay of Quinte. Historically, diverse macrophyte communities were lost, via competition, to milfoil and later, algae. Re-establishment of macrophytes may indicate an improved or healthy ecosystem. This work will measure the recent changes as an indicator of overall water quality.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT X  
GRANT

SOLICITED X  
UNSOLICITED

PROJECT TITLE: Aquatic Habitat Geographical Information  
System and its Application to Classification of  
Aquatic Vegetation and Piscivave Habitat in the Bay of  
Quinte - Phase I

PROJECT NO: A14292  
START DATE: 11/89

SHORT TITLE: GIS - Bay of Quinte Aquatic Habitat (Phase I)

PRINCIPAL INVESTIGATOR AND AFFILIATION: K. Loftus  
LGL Limited

LIAISON OFFICER (name, location, telephone no.): F. Stride  
Southeastern Region  
(613) 549-4000

OBJECTIVE(S): To produce GIS maps of the Bay of Quinte relevant to aquatic  
vegetation, pike habitat and shoreline uses.  
To produce a GIS model of factors (including man induced stresses and remedial  
actions) affecting aquatic vegetation and to relate that information to preferred  
pike habitat.

PROJECT DESCRIPTION: Develop is quickly altering the Bay of Quinte shoreline. At  
the same time, pollution has affected adversely water quality conditions.  
Remedial actions to control both these concerns will have an impact on aquatic  
vegetation and, in the long term, the structure of the fish community. A GIS will  
be used to illustrate - via maps - the estimated changes. The GIS employs natural  
factors (e.g. wind, substrate, fetch, etc.) and man-induced factors (e.g.  
shoreline alterations, point source discharges, etc.).

BUDGET AND RESOURCES:	Year: (* current)	1	2 *	3	TOTAL
	Cost: (000's):	20.0	34.0		54.0
	Work Years:	1.25			

Budget Source: Bay of Quinte Remedial Action Plan

KEYWORDS: GIS, aquatic vegetation, pike habitat, Bay of Quinte

OUTPUT (papers, presentation, reports): GIS report model, GIS maps,  
Workshop/Presentation to Quinte municipal planners and developers.

EXTERNAL PARTICIPATION (ministries, governments, agencies): MNR, DFO

COMMENTS: In progress, to be completed in October 1990.

NOTE: "External" refers to projects carried out by investigators outside the  
Ministry. Please indicate budget source by organization (e.g. RAC, OPAC,  
Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL  
INTERNAL X

CONTRACT  
GRANT X

SOLICITED  
UNSOLICITED X

PROJECT TITLE: Controlling Phosphorus Inputs at  
Source Economic and Environmental Assessment of  
Removing Phosphorus Before the STPs in the Bay of Quinte

PROJECT NO: MOE 199  
START DATE: 04/90

SHORT TITLE: Controllig P at Source

PRINCIPAL INVESTIGATOR AND AFFILIATION: C. Tomlin  
F. Stride  
Southeastern Region

LIAISON OFFICER (name, location, telephone no.): F. Stride  
Southeastern Region  
(613) 549-4000

OBJECTIVE(S): To determine whether removing P at source (e.g. detergents, automatic dishwasher detergent, food wastes, etc.) would have an impact on the operation of Bay of Quinte STPs; and to measure any environmental or economic changes.

PROJECT DESCRIPTION: Phosphorus concentrations from Quinte STP effluent is held to 0.5 mg/l in the May to October period. Further reductions (to 0.3 mg/l or less) are needed to improve Quinte water quality. Upgrading the 7 Quinte STPs to tertiary treatment has been estimated to cost about \$ 10 million (not including sewer improvements or operating costs). Reductions in P could be achieved at source -- in detergents, toilets, food wastes, etc. The economic and environmental costs are being evaluated.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
	Cost: (000's):	4.5			4.5
	Work Years: 0.25				

Budget Source: Environmental Youth Corp

KEYWORDS: phosphorus, Bay of Quinte, reductions at source

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: In progress, to be completed November 1990.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT X  
GRANT

SOLICITED X  
UNSOLICITED

PROJECT TITLE: Fate and Transport of Toxic Contaminants  
in the Bay of Quinte - Phase II

PROJECT NO: SER  
START DATE: 09/90

SHORT TITLE: Contaminant Fate - Quinte

PRINCIPAL INVESTIGATOR AND AFFILIATION: To be awarded

LIAISON OFFICER (name, location, telephone no.): D. Poulton  
Water Resources Branch  
(416) 323-4954  
F. Stride  
Southeastern Region  
(613) 549-4000

OBJECTIVE(S): To model the fate of 10 additional contaminants in the Bay of Quinte employing the fugacity model developed in Phase I of this study. (NOTE: Seasonality is not employed.)

PROJECT DESCRIPTION: Contaminants exceed Provincial guidelines for water, sediment (open water disposal of dredgate) and fish consumption. The contaminants of concern are Hg, Zn, Cu, PCB, Mivex, As, PCP and dioxins. As well, some agricultural pesticides are present in Quinte sediments. In 1989, the Quinte RAP team had a contractor develop a fate-transport model for Arsenic, Pentachlorophenol and PCB. In the case of As and PCP, the model was calibrated successfully with observed data. In 1990, the Quinte RAP team will expand the number of contaminants modelled.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (000's):	30.0	30.0		60.0
	Work Years: 1.5				

Budget Source: Bay of Quinte Remedial Action Plan

KEYWORDS: toxic contaminants, model, Bay of Quinte, fugacity, fate and transport

OUTPUT (papers, presentation, reports): "Modelled Fate of Contaminants" report, due December 1990.

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: The contaminants to be modelled will be those (1) found in the bay, or (2) where sufficient data exists.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

ONTARIO PESTICIDES ADVISORY COMMITTEE PROJECTS

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RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT  
GRANT X

SOLICITED  
UNSOLICITED X

PROJECT TITLE: Development of Disparvirus (gypsy moth nuclear polyhedrosis virus) as a microbial insecticide for use in Canada

PROJECT NO: OPAC 90-01  
START DATE: 04/90

SHORT TITLE: Disparvirus as an insecticide in Canada

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. J.C. Cunningham & W.J. Kaupp  
Sault College of Applied Arts & Tech

LIAISON OFFICER (name, location, telephone no.): Dr. C.R. Harris  
OPAC  
323-4447

OBJECTIVE(S): To conduct follow-up surveys on plots sprayed in 1988 and 1989 and untreated check plots and determine the long-term effect of Disparvirus treatments. To study spread of Disparvirus from a small, discreet site. To study leaf surface contamination with nuclear polyhedrosis virus as an early indicator of virus epizootics in gypsy moth populations.

PROJECT DESCRIPTION: The aim is to develop gypsy moth nuclear polyhedrosis virus (Disparvirus) as an effective and economical alternative to Bacillus thuringiensis for operational control of gypsy moth in Ontario. Parameters such as dosage, timing of applications, emitted volumes and tank mixes will be studied. Treated and check plots will be monitored for several years to determine long-term impacts of Disparvirus. Epizootiological studies will elucidate mechanisms of horizontal and vertical transmission and it is hoped that a survey of the amount of virus on leaf surfaces early in the season can be used as an indicator of an impending virus epizootic.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
	Cost: (000's):	17.7			17.7
	Work Years: 0.6				

Budget Source: OPAC

KEYWORDS: nuclear polyhedrosis virus, gypsy moth, biocontrol

OUTPUT (papers, presentation, reports): OPAC Seminar 1991

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)



RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT  
GRANT X

SOLICITED  
UNSOLICITED X

PROJECT TITLE: Sustainable Alternatives to  
Fumigation for the Control of Root Lesion  
Nematodes

PROJECT NO: OPAC 90-02  
START DATE: 04/90

SHORT TITLE: Alternatives to Fumigation/Root Lesion Nematodes

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. J.E. Brandle  
Delhi Res. Sta.

LIAISON OFFICER (name, location, telephone no.): Dr. C.R. Harris  
OPAC  
323-4447

OBJECTIVE(S): The first is to assess the nematocidal activity of isothiocyanates derived from rape leaves. The second is to establish a crop rotation, which will allow evaluation of rape as a viable alternative to soil fumigation. The ultimate goal is to provide farmers with a practical alternative that will allow chemical nematicides to be removed from the current cropping system.

PROJECT DESCRIPTION: Large amounts of soil fumigants are used to control root lesion nematodes in the coarse textured soils of southwestern Ontario. Rape leaves, stems and roots contain compounds known as glucosinolates, which are hydrolyzed to isothiocyanates when tissues are damaged. These plant derived isothiocyanate, which is a component of some soil fumigants used for nematode control. The purpose of this research is first to determine if the isothiocyanates derived from rape have nematocidal activity and secondly to evaluate rape as a rotational crop for use in suppression of nematode populations.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
Cost: (000's):		7.8			7.8
Work Years:	0.3				

Budget Source: OPAC

KEYWORDS: Brassica napus, nemotocidal activity of leaf derivatives, isotiocyanate soil fumigants

OUTPUT (papers, presentation, reports): OPAC Seminar 1991

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT  
GRANT X

SOLICITED  
UNSOLICITED X

PROJECT TITLE: Ecotoxicological Impact of Agricultural Runoff in Streams: The Effects of Atrazine, Metolachlor and Nutrient Interactions on Primary Productivity of Attached Algae PROJECT NO: OPAC 90-03  
START DATE: 03/90

SHORT TITLE: Ecotoxicological Impacts of Agricultural Runoff

PRINCIPAL INVESTIGATOR AND AFFILIATION: K.E. Day  
Rivers Research Branch National Water  
Research Institute

LIAISON OFFICER (name, location, telephone no.): Dr. C.R. Harris  
OPAC  
323-4447

OBJECTIVE(S): To develop methodology to determine the effects of agricultural chemicals, particularly atrazine and metolachlor on attached algae found growing in aquatic lotic ecosystems next to agricultural land. To determine the interactive effects of atrazine and metolachlor in combination with other agricultural contaminants such as NO<sub>3</sub>, -NO<sub>2</sub>, and phosphorus.

PROJECT DESCRIPTION: The ecotoxicological effects of two herbicides, atrazine and metolachlor, on the growth and productivity of attached algal communities (periphyton) will be determined. In the laboratory, the effects of short and long-term exposure (hours to weeks) to combinations of herbicides and different levels of nutrients will be studied under controlled conditions of light and temperature. The effects of short-term, pulsed doses of each herbicide on the photosynthetic activity of natural periphyto will also be determined in a portable streambank incubator.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
	Cost: (000's):	16.0			16.0
	Work Years: 1				

Budget Source: OPAC

KEYWORDS: pesticide runoff, impact on attached algae

OUTPUT (papers, presentation, reports): OPAC Seminar 1991

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT  
GRANT X

SOLICITED  
UNSOLICITED X

PROJECT TITLE: Reducing the Rates of Glyphosate  
to Control Broad-Leaved Trees in Conifer  
Populations

PROJECT NO: OPAC 90-04  
START DATE: 04/90

SHORT TITLE: Broad-Leaved Trees/Glyphosate Rates

PRINCIPAL INVESTIGATOR AND AFFILIATION: G. Hofstra  
University of Guelph

LIAISON OFFICER (name, location, telephone no.): Dr. C.R. Harris  
OPAC  
323-4447

OBJECTIVE(S): To determine the sensitivity of various broad-leaved trees to low rates of glyphosate at different times during the growing season. To determine the effect of low levels of glyphosate on white spruce and jack pine at different times during the growing season. To establish a strategy for conifer release using the levels of glyphosate. To continue the measurements in the field of the trees sprayed in 1987 and 1988.

PROJECT DESCRIPTION: To reduce the rate of glyphosate needed to control broad-leaved species in conifer plantations, and to increase the time period during which spraying can be done. Treatments in the field indicate that injury continues to develop over at least a 2 year period, and the ability of treat trees to compete and survive appears to diminish. If immediate kill of undesirable woody vegetation is not needed, lower field rates could suffice. Since applications at 25% RFR (Registered Federal Rate) showed quite significant declines in vigour and survival a reduction by 50% of the currently accepted rates could suffice for the control of deciduous weed species in conifer plantations.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
	Cost: (000's):	20.1			20.1
	Work Years: 1				

Budget Source: OPAC

KEYWORDS: glyphosate, conifer plantations, reduced rates

OUTPUT (papers, presentation, reports): OPAC Seminar 1991

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT  
GRANT X

SOLICITED  
UNSOLICITED X

PROJECT TITLE: Effectiveness of the Granulosis Virus  
in Management of the Codling Moth in Apple Orchards  
and its Environmental Impact

PROJECT NO: OPAC 90-05  
START DATE: 04/90

SHORT TITLE: Granulosis Virus and Apple Orchards

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. R. Jaques  
Agriculture Canada

LIAISON OFFICER (name, location, telephone no.): Dr. C.R. Harris  
OPAC  
323-4447

OBJECTIVE(S): To determine the effectiveness of the granulosis virus of the codling moth in a management system for apple orchards by laboratory bioassays, by a plot trial in a research orchard, in a grower's orchard under commercial conditions and for pear orchards in a small-scale test on pears. To determine the impact of the virus on nontarget arthropods, particularly species that are parasitic or predaceous. To evaluate persistence of the virus and identify materials to protect virus against inactivation by sunlight. To assemble data to support application for registration of the virus for use in Canada.

PROJECT DESCRIPTION: This study is to assess effectiveness of granulosis virus for control of the codling moth and the impact of the virus on nontarget arthropods by small-plot trials in research orchards and by a small-plot trial in a grower's orchard. Persistence of the virus will be assessed by field and laboratory techniques. These studies are to support application for registration of the virus for use as an alternative to chemical insecticides.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
Cost: (000's):		23.5			23.5
Work Years:	1				

Budget Source: OPAC

KEYWORDS: granulosis virus, codling moth nontarget impact

OUTPUT (papers, presentation, reports): OPAC Seminar 1991

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT  
GRANT X

SOLICITED  
UNSOLICITED X

PROJECT TITLE: Integration of Biological Control  
of Cucumber Powdery Mildew into the Greenhouse  
Pest Management Program

PROJECT NO: OPAC 90-06  
START DATE: 04/90

SHORT TITLE: Biological Control of Cucumber Mildew

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. W.R. Jarvis  
Agriculture Canada

LIAISON OFFICER (name, location, telephone no.): Dr. C.R. Harris  
OPAC  
323-4447

OBJECTIVE(S): To determine the compatibility of Sprothrix rugulosus and S. flocculosus with registered and candidate pesticides in cucumber production. To determine compatibility with insect predators and parasites Amblyseius cucumeris, Aphidoletes aphidimyza, Encarsia formosa and Hypoaspis sp. (potential control of fungus gnats and thrips). To determine compatibility with entomopathogens Verticillium lecanii, Aschersonia aleyrodis, and Bacillus thuringiensis.

PROJECT DESCRIPTION: A very effective biological control for cucumber powdery mildew has been developed. Two species of Stephanoascus which are yeastlike fungi, control this and other powdery mildew diseases (eg. or roses and begonia) at an optimum temperature of 26 degrees Celcius and at relative humidities greater than 80%. These conditions are provided by microfine fogging systems now common in many Ontario greenhouses. However, there is no information on the compatibility of this biological control with chemical pesticide and with insect predators, parasites, and entomopathogens.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
	Cost: (000's):	8.5			8.5
	Work Years: 0.5				

Budget Source: OPAC

KEYWORDS: cucumber powdery mildew, stephanoascus

OUTPUT (papers, presentation, reports): OPAC Seminar 1991

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT  
GRANT X

SOLICITED  
UNSOLICITED X

PROJECT TITLE: Impact of Algal Fibrils on  
Bioavailability of Pesticides to Non-target  
Aquatic Organisms

PROJECT NO: OPAC 90-07  
START DATE: 04/90

SHORT TITLE: Algal Fibrils/Bioavailability of Pesticides

PRINCIPAL INVESTIGATOR AND AFFILIATION: N.K. Kaushik  
University of Guelph

LIAISON OFFICER (name, location, telephone no.): Dr. C.R. Harris  
OPAC  
323-4447

OBJECTIVE(S): To investigate the role of algal fibrils in bioavailability of pesticides to nontarget organisms in water. To investigate bioavailability of fenvalerate to Daphnia magna and of atrazine to Anabaena cylindrica and Selenastrum capricornutum in the presence and absence of fibrils. A comparison with suspended sediments will indicate the relative importance of adsorption of pesticides by fibrils in a aquatic environment. Manipulating various parameters such as fibril dose, physical contact and contact time with fibrils and resulting effects on toxicity will also be investigated. Also, the production and manipulation of algae to produce fibrils will be pursued.

PROJECT DESCRIPTION: Algal fibrils are an important component of dissolved organic matter which have a role in the fate and bioavailability of contaminants in aquatic systems. Fibrils appeared to reduce the toxicity of fenvalerate to Daphnia magna. An adhesion reaction also occurred which impaired the mobility of D. magna. An adhesion reaction also occurred which impaired the mobility of D. magna. We wish to further investigate the interaction of fenvalerate to D. magna and atrazine toxicity to Anabaena cylindrica and Selenastrum capricornutum in the presence and absence of fibrils.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
Cost: (000's):		15.0			15.0
Work Years:	0.5				

Budget Source: OPAC

KEYWORDS: algal fibrils, aquatic organisms

OUTPUT (papers, presentation, reports): OPAC Seminar 1991

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT  
GRANT X

SOLICITED  
UNSOLICITED X

PROJECT TITLE: Evaluation of Alternate  
Methods of Pest Control for Home Garden

PROJECT NO: OPAC 90-08  
START DATE: 04/90

SHORT TITLE: Home Garden Pest Control Alternatives

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. D.G.R. McLeod  
University of Western Ontario

LIAISON OFFICER (name, location, telephone no.): Dr. C.R. Harris  
OPAC  
323-4447

OBJECTIVE(S): To test alternative means of reduction of pest damage in the home garden. To study the effect of different brands of floating row covers on growth of radish, onion and pepper. To examine the possibility of using Agronet floating row cover in the commercial production of organic peppers. The research will be summarized and a popular article.

PROJECT DESCRIPTION: To evaluate alternate means of pest control in home gardens and small truck farms. Mass trapping and companion planting will be tested for effect on preventing damage to radish, onion and cabbage. Fabric row covers will be tested for their effect on growth of radish, onion and peppers and their use and acceptability by truck crop farmers.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
	Cost: (000's):	18.0			18.0
	Work Years: 0.7				

Budget Source: OPAC

KEYWORDS: biocontrol, home garden, root maggots, polyester row covers, Aleochara bilineata

OUTPUT (papers, presentation, reports): OPAC Seminar 1991

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)



RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT  
GRANT X

SOLICITED  
UNSOLICITED X

PROJECT TITLE: Hyperparasitism and Strategies  
for the Biological Control of Gypsy Moth  
in Ontario

PROJECT NO: OPAC 90-09  
START DATE: 04/90

SHORT TITLE: Gypsy Moth Control in Ontario

PRINCIPAL INVESTIGATOR AND AFFILIATION: V.G. Nealis  
Forestry Canada

LIAISON OFFICER (name, location, telephone no.): Dr. C.R. Harris  
OPAC  
323-4447

OBJECTIVE(S): To estimate the impact of hyperparasitism on populations of parasitoids attacking gypsy moth in Ontario. To examine the relative vulnerability of new, potential agents to hyperparasitism. To make recommendations concerning the feasibility of particular biocontrol strategies using gypsy moth parasitoids in Ontario.

PROJECT DESCRIPTION: Both inundative and inoculative releases of parasitoids are established biocontrol strategies for gypsy moth in North America. Surveys of gypsy moth parasitoids already established in Ontario indicate that hyperparasitism may severely limit the effectiveness of releases of some parasitoids. This project will develop a method for estimating the impact of hyperparasitism on gypsy moth parasitoids and will examine through controlled experiments, the relative vulnerability of potential biocontrol candidates to hyperparasitism in Ontario. The results will assist pest managers in developing a decision-support system for the selection of biocontrol agents and strategies for their use in Ontario.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
	Cost: (000's):	13.8			13.8
	Work Years: 0.7				

Budget Source: OPAC

KEYWORDS: hyperparasitism, gypsy moth, biocontrol agents/strategies

OUTPUT (papers, presentation, reports): OPAC Seminar 1991

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT  
GRANT X

SOLICITED  
UNSOLICITED X

PROJECT TITLE: Organic and Modified Programs  
for the Control of Apple Scab.

PROJECT NO: OPAC 90-10  
START DATE: 04/90

SHORT TITLE: Apple Scab. Control

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. J. Northover  
Agriculture Canada

LIAISON OFFICER (name, location, telephone no.): Dr. C.R. Harris  
OPAC  
323-4447

OBJECTIVE(S): To determine the rate of dissipation and terminal harvest residues on apple fruits sprayed with mancozeb 45, 60 and 75 days prior to harvest. To determine the relative efficacies of five readily available vegetable oils applied to potted McIntosh and McIntosh seedling plants as oil-in-water emulsions for protections against, or inactivation of apple scab.

PROJECT DESCRIPTION: The project will research more acceptable and sustainable means of controlling apple scab (*Venturia inaequalis*). One approach will examine the rate of dissipation and the terminal harvest residues of mancozeb on apples sprayed with longer preharvest intervals than the current 30 days. The other approach will evaluate the efficacy of an "organic" method involving the application of emulsified vegetable oils in water.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
	Cost: (000's):	10.0			10.0
	Work Years: 0.4				

Budget Source: OPAC

KEYWORDS: scab/(*Venturia inaequalis*), mancozeb residue decline, emulsified vegetable oil efficacy

OUTPUT (papers, presentation, reports): OPAC Seminar 1991

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT  
GRANT X

SOLICITED  
UNSOLICITED X

PROJECT TITLE: New Technology for Insecticide  
Placement to Control Soil Insects in Row Crops  
at Cultivation Time

PROJECT NO: OPAC 90-11  
START DATE: 05/90

SHORT TITLE: New Technology for Insecticide Placement

PRINCIPAL INVESTIGATOR AND AFFILIATION: Mr. A.W. Schaafsma  
Ridgetown College of Agricultural  
Technology

LIAISON OFFICER (name, location, telephone no.): Dr. C.R. Harris  
OPAC  
323-4447

OBJECTIVE(S): To design, develop and modify injection applicators to achieve optimum insecticide placement for corn rootworm control injection when corn rootworm larvae are active. To test prototype injection equipment for commercial utility in rootworm insecticide applications.

PROJECT DESCRIPTION: Focuses on developing a modified approach to corn rootworm control to reduce the amount of insecticide applied to Ontario soils by order of magnitude of about 75%. Developing new insecticide application technology for soil insect control has been identified as a research priority by the Field Crops Recommendation Subcommittee as first priority for long term funding. The 1989 grant supported construction and testing (small plot) of a manual injector. The 1990 work is to design and construct a 2 row slot injector for larger scale field trials.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
	Cost: (000's):	6.0			6.0
	Work Years: 0.4				

Budget Source: OPAC

KEYWORDS: western corn rootworm, layby soil injection equipment design

OUTPUT (papers, presentation, reports): OPAC Seminar 1991

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT  
GRANT X

SOLICITED  
UNSOLICITED X

PROJECT TITLE: Management of the Strawberry Root  
Weevil in Ornamental Tree Nursery Production  
using Entomophagous Nematodes

PROJECT NO: OPAC 90-12  
START DATE: 04/90

SHORT TITLE: Strawberry Root Weevil Management

PRINCIPAL INVESTIGATOR AND AFFILIATION: S.M. Smith  
University of Toronto

LIAISON OFFICER (name, location, telephone no.): Dr. C.R. Harris  
OPAC  
323-4447

OBJECTIVE(S): To develop a pest management program for the strawberry root weevil on ornamental spruce nurseries in southern Ontario. This will be achieved by determining the life-cycle and biology of the weevil in southern Ontario; by developing a non-destructive sampling technique for predicting weevil infestation; and by selecting and releasing entomophagous nematodes for biological control of the weevil under laboratory and field conditions.

PROJECT DESCRIPTION: The strawberry root weevil is a relatively recent pest in Ontario tree nurseries, limited the production of ornamental conifer stock. No management guidelines are currently available for control of this important pest. The proposed research will develop a pest management program for strawberry root weevil by addressing 3 objectives listed above. Adult weevils will be released into caged trees at the field site and the trees sampled bi-monthly from May 1990 to April 1991 to measure weevil development. A number of different non-destructive sampling techniques will be investigated for predicting weevil infestation. Entomophagous nematodes will be released against the weevil in laboratory and field trials using surface and injection techniques.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
	Cost: (000's):	18.0			18.0
	Work Years:	0.8			

Budget Source: OPAC

KEYWORDS: strawberry root weevil biology, biocontrol, entomophagous nematodes

OUTPUT (papers, presentation, reports): OPAC Seminar 1991

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT  
GRANT X

SOLICITED  
UNSOLICITED X

PROJECT TITLE: Integrated Weed Management  
Systems with Onions on Muck Soils

PROJECT NO: OPAC 90-13  
START DATE: 04/90

SHORT TITLE: Weed Management and Muck Soils

PRINCIPAL INVESTIGATOR AND AFFILIATION: V. Souza Machada  
University of Guelph

LIAISON OFFICER (name, location, telephone no.): Dr. C.R. Harris  
OPAC  
323-4447

OBJECTIVE(S): To evaluate the effect of cover crops on the weed pressure during the subsequent crops of onions on muck soils. To establish the "critical period" of broadleaf and grass weed interference with onions on muck soils. Field responses of osmoconditioned onions in relation to early seeding establishment and development. Interaction of barley wind abatement plantings as rows or broadcast, with onions and broadleaf weeds.

PROJECT DESCRIPTION: The objectives of the program are to manipulate interspecific crop/weed competition, involving the introduction of "protector" species that would be used as a winter cover species and a spring abatement species, so as to reduce weed interference with the "protected" crop as well as minimize wind erosion. The "protected" crop would also be primed with polyethylene glycol prior to field planting, so as to enhance seedling vigour at low germination/emergence soil temperatures and be therefore more effective in weed competition. This strategy would hopefully maintain crop yields, lower the volume of herbicides used in the environment and prevent the loss of valuable horticultural topsoil from farmlands.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
Cost: (000's):		16.0			16.0
Work Years:	1				

Budget Source: OPAC

KEYWORDS: crop/weed competition, "protector species", polyethylene glycol

OUTPUT (papers, presentation, reports): OPAC Seminar 1991

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT  
GRANT X

SOLICITED  
UNSOLICITED X

PROJECT TITLE: Biological Control of Grey Mold  
in Strawberries

PROJECT NO: OPAC 90-14  
START DATE: 04/90

SHORT TITLE:

PRINCIPAL INVESTIGATOR AND AFFILIATION: J.C. Sutton  
University of Guelph

LIAISON OFFICER (name, location, telephone no.): Dr. C.R. Harris  
OPAC  
323-4447

OBJECTIVE(S): To evaluate biocontrol agents for effectiveness in suppressing grey mold fruit rot of strawberries in the field. To screen additional isolates of fungal species show to be effective in biocontrol. To quantify effects of weather variables on the population dynamics of biocontrol agents applied to strawberries and on their effectiveness in suppressing grey mold. To develop systems to apply and time applications of biocontrol agents.

PROJECT DESCRIPTION: To develop biological control as an alternative to fungicides for managing grey mold fruit rot of strawberries. Organisms in advanced stages of screening as biocontrol agents will be evaluated in field plots. Effects of weather factors on population densities of the biocontrol agents in strawberry plants and on effectiveness of the agents in suppressing grey mold will be determined. These and other observations will be used to develop a system to optimize biocontrol through appropriate timing of applications of the biocontrol agents.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
	Cost: (000's):	22.0			22.0
	Work Years: 1.5				

Budget Source: OPAC

KEYWORDS: grey mold fruit rot, biocontrol agents

OUTPUT (papers, presentation, reports): OPAC Seminar 1991

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT  
GRANT X

SOLICITED  
UNSOLICITED X

PROJECT TITLE: Development of a Colour Trap to  
Detect and Monitor flies, Stobilomyia spp. infesting  
Coniferous Cones in Seed Orchards

PROJECT NO: OPAC 90-15  
START DATE: 04/90

SHORT TITLE: Colour Trap to Detect and Monitor Flies

PRINCIPAL INVESTIGATOR AND AFFILIATION: J.J. Turgeon  
University of Toronto

LIAISON OFFICER (name, location, telephone no.): Dr. C.R. Harris  
OPAC  
323-4447

OBJECTIVE(S): Continue field-screening tests to determine the most attractive colour for traps located in trees to flies of Strobilomyia sp. Continue field tests to identify the position of the traps that is most effective in attracting flies before oviposition begins. Determine the level of sexual maturity of females caught on traps as a function of time as well as determine the exact period of oviposition in the site.

PROJECT DESCRIPTION: To develop a colour trap to detect and moitor adults of cone maggots, by carrying out field experiments in Ontario with 3 cone maggots which develop in tamarack cones, and infest spruce cones. To obtain information needed to develop this traps we will assess their response to traps of different colours, hues, shapes and sizes as well as determine the influence of trap location and height within a stand on trap capture. The final step of this project will be to correlate trap catches with damage inflicted by these flies.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
	Cost: (000's):	22.0			22.0
	Work Years: 0.5				

Budget Source: OPAC

KEYWORDS: cone maggots, tamarock cones and spruce cones

OUTPUT (papers, presentation, reports): OPAC Seminar 1991

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)



RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT  
GRANT X

SOLICITED  
UNSOLICITED X

PROJECT TITLE: Reducing Weed Competition in  
Corn Through Nitrogen Management

PROJECT NO: OPAC 90-16  
START DATE: 04/90

SHORT TITLE:

PRINCIPAL INVESTIGATOR AND AFFILIATION: G. Hofstra  
University of Guelph

LIAISON OFFICER (name, location, telephone no.): Dr. C.R. Harris  
OPAC  
323-4447

OBJECTIVE(S): To determine if the need for chemical weed control can be reduced by altering fertility regimes in corn. To compare weed species diversity and biomass under different fertility regimes in corn under organic and conventional practices. To relate weed species diversity to the level of nitrogen and nitrate in the soil. To compare weed establishment in the spring in plots treated with either turkey manure in the fall, followed by catch crops or with nitrate in the spring. To compare the effect of nitrogen supplied by a green manure crop with that supplied by nitrate on weed establishment in corn. To study the effects of different forms of nitrogen on weed seed germination.

PROJECT DESCRIPTION: To develop a colour trap to detect and monitor adults of cone maggots, by carrying out field experiments in Ontario with 3 cone maggots which develop in tamarack cones, and which infest spruce cones. To obtain information needed to develop this trap we will assess their response to traps of different colours, hues, shapes and sizes as well as determine the influence of trap location and height within a stand on trap capture. The final step of this project will be to correlate trap catches with damage inflicted by these flies.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
	Cost: (000's):	16.1			16.1
	Work Years: 0.5				

Budget Source : OPAC

KEYWORDS: nitrate, weed seed dormancy/germination, species diversity

OUTPUT (papers, presentation, reports): OPAC Seminar 1991

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT  
GRANT X

SOLICITED  
UNSOLICITED X

PROJECT TITLE: Integrated Weed Management in  
White Beans

PROJECT NO: OPAC 90-17  
START DATE: 04/90

SHORT TITLE:

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. C.J. Swanton  
University of Guelph

LIAISON OFFICER (name, location, telephone no.): Dr. C.R. Harris  
OPAC  
323-4447

OBJECTIVE(S): To develop a weed threshold management model for post-emergence herbicide use in white beans. To compare the residual dissipation curves of metobromuron and bentazon in white beans grown under conventional management and integrated weed management system.

PROJECT DESCRIPTION: Field research will be conducted to develop a computerized weed threshold management model for postemergence weed control in white beans. The first component of this research is to determine threshold levels of major broadleaf weed escapes during the critical period that result in yield losses. This study will refine our reduced-pesticide weed control system in white beans. The second component of this research will test the hypothesis that pesticide residues in bean seeds can be reduced or eliminated and weeds still effectively controlled if an IWM production system with reduced herbicide dosage and properly timed herbicide application is adopted.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
	Cost: (000's):	16.0			16.0
	Work Years: 0.9				

Budget Source: OPAC

KEYWORDS: integrated weed management (IWM), white beans, post emergent herbicides/ efficacy

OUTPUT (papers, presentation, reports): OPAC Seminar 1991

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT  
GRANT X

SOLICITED  
UNSOLICITED X

PROJECT TITLE: Interaction Among an Outbreak  
of Jack Pine Budworm, B.t. beneficial Lepidoptera  
Spruce Grouse, Amphibia, and Small Birds and Mammals

PROJECT NO: OPAC 90-18  
START DATE: 04/90

SHORT TITLE:

PRINCIPAL INVESTIGATOR AND AFFILIATION: J.F. Bendell  
University of Toronto

LIAISON OFFICER (name, location, telephone no.): Dr. C.R. Harris  
OPAC  
323-4447

OBJECTIVE(S): To complete the project begun in 1989, assessing the impact of  
operational spraying B.t. on wildlife and non-target Lepidoptera. To make direct  
observation of chicks in sprayed areas allotted to and brooded by Bantam Lens.

PROJECT DESCRIPTION: We operationally sprayed two 40 ha plots of 20 year old Jack  
Pine with B.t., 30 BIU in 1.8 a/ha and measured the impact on wildlife, and  
arthropods of low shrubs, herbs and forest floor. Preliminary analysis suggest  
the B.t. decreased number of three foraging song birds, chicks of Spruce Grouse,  
and caterpillars of low shrubs and gerbs. Masked Shrews and American Toads were  
unaffected. Many data remain unanalyzed: 201 sweep net and 664 pitfall samples  
of arthropods, census data on song birds and grouse; and 150 measurements of growth  
and contents of 40 crops of chicks of grouse.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
	Cost: (000's):	16.5			16.5
	Work Years: 1.6				

Budget Source: OPAC

KEYWORDS: Jack Pine Budworm, beneficial Lepidoptera, Spruce Grouse, Amphibia

OUTPUT (papers, presentation, reports): OPAC Seminar 1991

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the  
Ministry. Please indicate budget source by organization (e.g. RAC, OPAC,  
Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT  
GRANT X

SOLICITED  
UNSOLICITED X

PROJECT TITLE: Optimization of Pathogen-  
Parasitoid interactions for Integrated Management  
of Eastern Spruce Budworm, Choristoneura fumiferana

PROJECT NO: OPAC 90-19  
START DATE: 04/90

SHORT TITLE:

PRINCIPAL INVESTIGATOR AND AFFILIATION: K. van Frankenhuyzen  
Bacterial Pathogens

LIAISON OFFICER (name, location, telephone no.): Dr. C.R. Harris  
OPAC  
323-4447

OBJECTIVE(S): To develop a solid experimental basis for a spruce budworm population management strategy by testing hypotheses regarding the interaction between Bacillus thuringiensis, parasitoids, and budworm performance. Laboratory experiments will be conducted to further investigate interactive effects between B.t. and parasitoids, building on our previous work and to quantify carry-over effects of B.t. on budworm population quality. Laboratory observations will be complemented with observations from a field trial, designed to test the hypothesis that a properly-timed B.t. application can result in foliage protection as well as population suppression by enhancing effectiveness of parasitoids and debilitating budworm fitness.

PROJECT DESCRIPTION: Recent progress in spruce budworm research indicates the possibility of developing a population management strategy by integrating our knowledge of microbial control agents with that of the population biology of the budworm and its natural enemies. We propose to develop the experimental basis for a population management strategy based on optimization of parasitoid-pathogen interactions. Experiments will be conducted to examine interactive effects between B.t. and parasitoids on survival and performance of spruce budworm in the laboratory, and to test results of laboratory experiments in the field by aerial treatment of high density budworm populations.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
Cost: (000's):		16.0			16.0
Work Years:	0.8				

Budget Source: OPAC

KEYWORDS: pathogen-parasitoid, integrated management, eastern spruce budworm

OUTPUT (papers, presentation, reports): OPAC Seminar 1991

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1990

EXTERNAL X  
INTERNAL

CONTRACT  
GRANT X

SOLICITED  
UNSOLICITED X

PROJECT TITLE: Response of Soil Microfauna,  
Microflora and Structure to Agricultural  
Practices in Corn, Soybean and Cereal Rotation

PROJECT NO: OPAC 90-20  
START DATE: 04/90

SHORT TITLE:

PRINCIPAL INVESTIGATOR AND AFFILIATION: A.D. Tomlin  
University of Western Ontario

LIAISON OFFICER (name, location, telephone no.): Dr. C.R. Harris  
OPAC  
323-4447

OBJECTIVE(S): To measure soil microfaunal, microfloral and soil physical properties in response to these treatments. Visual observations clearly indicate changes in soil structure, under continuous herbicide treatments, presumably related to faunal, floral and microfabric changes we hope to identify. An adjacent experiment beginning at Harrow in 1990, will compare reduced herbicide treatments in conjunction with tillage and crop rotation for weed control in soybeans, providing us with the additional opportunity to compare tillage effects on soil biota and soil structure.

PROJECT DESCRIPTION: Evaluation of the effects of herbicide treatments, crop rotations, and tillage practices on soil biota and soil structure using currently and newly established plots at North woodslee Stn. (Harrow Res. Stn.). Soil textures also will be mapped at the site in 1990 to measure soil heterogeneity in preparation for subsequent soil faunal, floral and soil porosity measurements in relation to the main treatment effects.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
	Cost: (000's):	14.7			14.7
	Work Years: 1				

Budget Source: OPAC

KEYWORDS: herbicides effect on soil structure, microflora, corn, soybean and cereal rotations

OUTPUT (papers, presentation, reports): OPAC Seminar 1991

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)



